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FIRST OUTLINES

OF A

DICTIONARY OF SOLUBILITIES

OF

CHEMICAL SUBSTANCES.

BY FRANK H. STORER.

3

CAMBRIDGE:
SEVER AND FRANCIS.
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Very slowly and slightly soluble in a boiling aqueous solution of chloride of ammonium. (H. Rose, *Tr.*)

b = *hydrated.* Decomposed to *a* on boiling with water. More readily soluble in acids than metallic tin or the anhydrous protoxide. (Berzelius.) Soluble in aqueous solutions of caustic potash, and soda, even dilute; sparingly soluble [insoluble (H. Rose, *Tr.*)] in a solution of carbonate of ammonia; nearly insoluble in ammonia-water, and in a solution of carbonate of potash (Wittstein); soluble also in solutions of caustic lime, and baryta: all these alkaline solutions are decomposed on boiling. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** pp. 460, 465.) Sparingly soluble in an aqueous solution of acetate of soda. (Mercer.) It is not precipitated by ammonia from solutions containing citrate of soda. (Spiller.) Somewhat soluble in an aqueous solution of waterglass (acid silicate of soda or potash). (Ordway, *Am. J. Sci.*, (2.) **32.** 338; compare *Ibid.*, **33.** 33.) Soluble in aqueous solutions of hydrated oxide of stibethylium, and of hydrate of triethyltoluenylammonium. Those of the salts of protoxide of tin which are insoluble in water are soluble in chlorhydric acid and in a solution of chloride of ammonium, i. e. if they have not been ignited.

$2\,Sn\,O, H\,O$

When boiled with a very dilute solution of caustic potash, so long as it continues to dissolve, 16 pts. of oxide to 1 pt. of potash will be taken up. When this solution is evaporated, it forms a jelly which slowly dries up to a mass, which is still soluble in water; but if this mass is ignited, the compound of potash and tin is decomposed, and water now dissolves nothing but potash from the mixture. A solution of carbonate of potash also dissolves hydrate of tin, under certain conditions. Thus, when a solution of carbonate of potash is poured upon the hydrate it combines therewith, but the resulting compound does not dissolve in the alkaline liquid. If the latter be now decanted, the precipitate washed with a little cold water, and then treated with a larger quantity of pure water, an emulsion-like liquid is obtained, in which, however, carbonate of potash produces a precipitate. This action of the alkaline carbonates is due to the formation of a certain quantity of bicarbonate, by the action of the oxide of tin. When precipitated with basic succinate of ammonia, oxide of tin is completely insoluble. (Berzelius, *Lehrb.*, **2.** 191.) Even when recently precipitated it is only sparingly soluble in an aqueous solution of chloride of ammonium, either hot or cold. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 98.)

"Yellow Oxide of Tin." *Vid.* MetaStannate of Soda.

*Per*Oxide of Tin.

a = *anhydrous.* Insoluble in water, acids, concentrated alkaline solutions or caustic ammonia. Not absolutely insoluble in dilute nitric acid. (Mülder, *Die Silberprobirmethode*, p. 12.) Only traces of it can be dissolved by long-continued ebullition in chlorhydric or concentrated sulphuric acid. (H. Rose, *Tr.*)

(*Stannic Oxide.*) $Sn\,O_2$

b = *hydrated.*

α) $Sn\,O_2, H\,O$ (*Ordinary Oxide of Tin. Stannic Acid.*) Soluble, with combination, in chlorhydric and sulphuric acids, even when these are dilute. Soluble in alkalies. One modification of it is soluble, another is insoluble, in caustic ammonia. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 481.) Easily soluble in an aqueous solution of caustic potash, but on adding to this solution still more potash a precipitate may form, since stannate of potash is difficultly soluble in a concentrated solution of potash; on adding water, however, this may be immediately redissolved. Somewhat soluble, though sparingly, in ammonia-water. Completely soluble in an aqueous solution of carbonate of potash, but not completely soluble in a solution of carbonate of soda. Carbonate of ammonia behaves like caustic ammonia. Insoluble in aqueous solutions of the alkaline bicarbonates or of chloride of ammonium. Easily soluble in acids, especially in dilute sulphuric and in nitric and chlorhydric acids. From all these acid solutions the oxide may be reprecipitated by largely diluting with water and then boiling, the precipitation being the more complete in proportion as less acid and more water is present. (H. Rose, *Tr.*) While still moist it is slightly soluble in nitric acid; but from this solution it gradually separates on standing, and coagulates at once when the liquid is heated to 50°; if nitrate of ammonia be added to the solution, this remains clear at the ordinary temperature. If the oxide precipitated by heating the solution is treated first with ammonia, and then with nitric acid, it redissolves. (Berzelius, *Lehrb.*, **2.** 596.) Soluble in solutions of the alkaline sulphides. (Berzelius, *Lehrb.*, **2.** 600.) Soluble in an excess of an aqueous solution of hydrate of triethyltoluenylammonium. It is not precipitated by ammonia from solutions which contain citrate of soda. (Spiller.) Though insoluble in nitric acid, peroxide of tin dissolves when treated with nitric acid and ammonia. (Thénard, *Ann. de Chim.*, **43.** 218. [T.].)

On drying the hydrate which has been precipitated from the bichloride by ammonia it preserves all its properties, and dissolves easily in chlorhydric acid; on heating it to 50° it loses its water, but is otherwise unchanged; heated to 80° it becomes more difficultly soluble in chlorhydric acid, a portion remaining undissolved; but that which does dissolve is still the modif. α; on heating to 130° it loses no more water, but a portion of it is still soluble in chlorhydric acid; on ignition it ceases to be soluble in chlorhydric acid, being less soluble therein in proportion as it has been more strongly heated. (H. Rose, *Tr.*, **1.** 252.)

Most of the salts of α oxide of tin are soluble in water, without decomposition. Those of them which are insoluble in water dissolve in chlorhydric acid; they are insoluble, however, in solutions of chloride of ammonium.

β) Insoluble in water, or in nitric or sulphuric acids. Sparingly soluble in chlorhydric acid. (Fresenius, *Quant.*, p. 154.) Insoluble in nitric acid, even when previously treated with caustic ammonia (Berzelius, *Lehrb.*), in concentrated sulphuric acid, only swelling up therein. Scarcely at all dissolved by chlorhydric acid, but combines therewith to a salt which is insoluble in chlorhydric acid; this compound is soluble in water, however. (Berzelius, *Lehrb.*)

(*Anomalous Oxide. MetaStannic Acid.*) $Sn_5\,O_{10}, 5\,H\,O$ (of Fremy).

When metallic tin is oxidized by means of nitric acid, the oxide (β) obtained is completely insoluble in an excess of the acid and in water; if this oxide be freed from adhering nitric acid, by careful washing, and then treated with chlorhydric acid, it does not dissolve, but on heating the mixture of chlorhydric acid and oxide, and subsequently adding water, a clear solution is obtained, which, however, behaves with many reagents in an entirely different manner from an aqueous solution of sublimed bichloride of tin or a chlorhydric acid solution of the oxide α. (H. Rose, *Tr.*, **1.** 247.) On diluting the chlorhydric solution of modif. β with much water, and then boiling, a portion of the oxide (β) is reprecipitated, and this reaction occurs more readily than with the chloride of the other modification (α). (H. Rose, *Tr.*) Neither of the modifications of binoxide of tin are soluble in a solution of chloride of ammonium, even after long-continued ebullition. (H. Rose, *Tr.*, **1.** 253.)

Entirely insoluble in caustic ammonia. Soluble in solutions of the alkalies; if such alkaline solution be neutralized by an acid, another hydrate of tin is precipitated insoluble in nitric acid, but soluble in all proportions in caustic ammonia. (Fremy, *Ann. Ch. et Phys.*, (3.) **23.** 402.) Insoluble in acids, in a solution of caustic ammonia, or of carbonate of ammonia. Imperfectly soluble in solutions of the alkalies or alkaline carbonates. (Fremy, in *Gm.*) Insoluble in a solution of carbonate of potash. (H. Rose.)

The oxide (β) obtained by the action of nitric acid on metallic tin is completely soluble in an aqueous solution of caustic potash, as is also the hydrate precipitated on neutralizing the chlorhydric-acid solution; solutions thus obtained are apt to be cloudy at first, but clear up after a time on standing. The addition of more potash is liable to produce a slight precipitate, but this disappears again on the addition of water. [Compare Stannate of Potash (β).] Insoluble in aqueous solutions of the alkaline carbonates or bicarbonates. (H. Rose, *Tr.*)

The salts of β oxide of tin are generally difficultly soluble in water, and are decomposed thereby to insoluble basic salts and free acid. (Berzelius, *Lehrb.*)

*Prot*OXIDE OF TIN with *bin*OXIDE OF TIN.
(*SesquiOxide of Tin.*)
$Sn_2O_3 = SnO, SnO_2$

While yet moist, it is tolerably easily and completely soluble in ammonia-water. (Berzelius.) Difficultly soluble in dilute, more easily soluble in concentrated chlorhydric acid.

OXIDE OF TITANIUM.
(*Titanous Oxide.*)
TiO

Insoluble in acids, even fluorhydric.

*Sesqui*OXIDE OF TITANIUM.
(*Black Oxide of Titanium.*)
Ti_2O_3

When prepared in the moist way it is insoluble in water or ammonia-water, but quickly oxidizes to titanic acid. It is soluble in the oxygen acids, but is oxidized very readily in these solutions. (Berzelius, *Lehrb.*, **2.** 386.) When prepared in the dry way it is soluble in great part in acids. (Berthier.) Soluble in sulphuric acid. Unacted upon by chlorhydric or nitric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **20.** 392.)

OXIDE OF TOLUENYL.
(*Oxide of Benzyl. Oxide of Benz-Ethyl. Benzylic Ether. Toluenyl Ether. Benzol Ether.*)
$C_{14}H_7O$, or $\left.\begin{matrix}C_{14}H_7\\C_{14}H_7\end{matrix}\right\} O_2$

Insoluble in water. Decomposed by concentrated sulphuric acid and by phosphoric acid. (Cannizaro, *Ann. Ch. u. Pharm.*, **92.** 115.)

OXIDE OF TUNGSTEN.
(*Tungstous Oxide. Brown Oxide of Tungsten.*)
WO_2

Insoluble in water. Sparingly soluble in cold, more readily soluble in hot chlorhydric and sulphuric acids. Readily soluble, with decomposition, in a concentrated solution of caustic potash. Insoluble in boiling ammonia-water. (Riche.)

"BLUE OXIDE OF TUNGSTEN."
(*Tungstic Oxide.*)

Vid. Tungstate of Tungsten.

OXIDE OF TURPENTINE-OIL.
(*Isomeric with Campholic Acid.*)
$C_{20}H_{18}O_4$

Soluble in water, alcohol, and ether, and crystallizes from the hot solutions on cooling. (Sobrero.)

*Sub*OXIDE OF URANIUM(?).
$Ur_4O_3(?)$

Ppt. Decomposed by water, and by exposure to the air. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 22.)

*Prot*OXIDE OF URANIUM.
(*Formerly mistaken for metallic Uranium.*)
UrO

a = anhydrous. When prepared in the dry way, it is unacted upon by dilute chlorhydric or sulphuric acid, even when these are boiling. Soluble in concentrated sulphuric acid, and in nitric acid. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 25.)

b = hydrated. Easily soluble in dilute acids, with combination. (Péligot, *loc. cit.*) Insoluble in aqueous solutions of the caustic alkalies, or of the carbonates of potash, soda, or ammonia. (Berzelius, *Lehrb.*, **2.** 778.) Soluble in aqueous solutions of the alkaline carbonates, especially of carbonate of ammonia. (Rammelsberg.)

*Sesqui*OXIDE OF URANIUM.
(*Uranic Oxide*)

a = anhydrous. Easily soluble in nitric acid.
Ur_2O_3
(Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 9.)

b = hydrated. Permanent. Insoluble in water.
Ur_2O_3, HO
Very easily soluble in cold dilute nitric acid. (Malaguti, *Ann. Ch. et Phys.*, (3.) **9.** 463.) Easily soluble in acids. (Berzelius, *Lehrb.*) Soluble in boiling aqueous solutions of the nitrates of the sesquioxides of iron and bismuth, and of the din- and protoxides of mercury, with precipitation of the oxides in these salts. (Persoz, *Chim. Moléc.*, p. 366.) Not decomposed by a boiling aqueous solution of chloride of ammonium, which nevertheless dissolves a very small quantity of it. (H. Rose, *Tr.*) Insoluble in aqueous solutions of caustic ammonia, potash, or soda. Easily soluble in an aqueous solution of sesquicarbonate of ammonia, and of bicarbonate of potash, or of soda; also soluble, though less readily, in a dilute solution of monocarbonate of potash. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 220.) Soluble in aqueous solutions of carbonate or bicarbonate of potash, and of soda. (Chevreul.) When in presence of non-volatile organic substances, like tartaric acid, it is not precipitated by the alkalies. (H. Rose, *Tr.*) Most of its compounds with acids are easily soluble in acids. For its compounds with bases, see URANIC ACID.

*Prot*OXIDE OF URANIUM with *Sesqui*OXIDE OF URANIUM.

I.) $Ur_3O_4 = UrO, Ur_2O_3$
(*Olive-green Oxide of Uranium. Tritoxide of Uranium.*)

a = anhydrous. Soluble in acids, with decomposition, forming salts of the proto- and sesquioxide. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 27.) Not attacked by cold dilute acids. Easily soluble in nitric acid. Soluble in warm, very dilute sulphuric acid. On digesting with chlorhydric acid a portion dissolves while the residue contains more of the protoxide than at first, since the sesquioxide dissolves by preference. Insoluble, even when hydrated, in an aqueous solution of caustic potash. (H. Rose, *Tr.*) After ignition, it is but difficultly soluble in dilute chlorhydric or sulphuric acid; it is more readily soluble in hot strong acids, being completely dissolved by concentrated sulphuric acid. (Arfvedson.)

b = *hydrated.* Easily soluble in acids, excepting when it has been boiled with water for a long time. Soluble in aqueous solutions of the alkaline carbonates.

II.) $Ur_4O_5 = 2UrO; Ur_2O_3$ (*Black Oxide of Uranium. Deutoxide of Uranium.*) Soluble in acids, with decomposition, forming salts of the proto- and sesquioxide. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 26.)

***Sub*Oxide of Vanadium.** Insoluble in water, VO acids, or alkaline solutions, when out of contact with the air.

***Bin*Oxide of Vanadium.**
(*Vanadic Oxide. Vanadous Acid.*)

a = *anhydrous.* After ignition it is only slowly, VO_2 though completely, soluble in acids.

b = *hydrated.* Insoluble in water. Soluble in VO_2, HO acids. Exceedingly sparingly soluble in succinic acid. (Berzelius.) Soluble in aqueous solutions of the caustic, carbonated, and bicarbonated alkalies, including carbonate of ammonia. Most of the hydrated salts of vanadic oxide are soluble in water.

"Purple Oxide of Vanadium." Soluble in water.

"Green Oxide of Vanadium." (*Yellow Oxide of Vanadium. Yellow-Green Oxide of Vanadium. Orange-Yellow Oxide of Vanadium.*) *Vid.* Vanadiate of Vanadium.

Oxide of Yttrium.
(*Yttria.*)

a = *anhydrous.* After ignition it is scarcely YO soluble in acids. (Odling.) Readily soluble in acids. Insoluble in ammonia-water. Difficultly soluble in a solution of caustic potash. (Wœhler.) Readily soluble in acids; even after having been subjected to a very intense red heat it dissolves easily in chlorhydric acid. The calcined oxide evolves much heat, and dissolves, when treated with dilute acids. (H. Rose, *Tr.*)

b = *hydrated.* Insoluble in water, or in aque- YO, HO ous solutions of the caustic alkalies, either cold or boiling, but soluble in solutions of the alkaline carbonates.

Completely insoluble in a solution of caustic potash. Ammonia-water precipitates it even from solutions which contain a certain proportion of an ammoniacal salt, but there must not be too much of the latter. When recently precipitated, it dissolves easily in a warm solution of chloride of ammonium, ammonia being evolved, but with the calcined oxide this reaction is slower and incomplete. (H. Rose, *Tr.*) Easily soluble in an aqueous solution of carbonate of ammonia, with combination; on boiling this solution the hydrate of yttria is completely reprecipitated, unless other saline substances are present, when the precipitate which at first forms on boiling is soon redissolved. Also soluble in a solution of carbonate of soda. (Berzelius, *Lehrb.*, **2.** 176.) Soluble in sulphurous acid. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 75.) Readily soluble in the acids generally. The presence of non-volatile organic substances, like tartaric acid, does not prevent its precipitation by ammonia, though the precipitation may be somewhat retarded. In presence of tartaric acid, carbonate of soda does not produce any precipitate, at least for several days, unless ammonia be also added. (H. Rose, *Tr.*)

***Sub*Oxide of Zinc.** Exceedingly slowly soluble in boiling acids.

Oxide of Zinc. Insoluble in water. Readily ZnO & $+ HO$ soluble in acids, even after having been strongly ignited. Some samples of oxide of zinc are sensibly soluble in water, others are not, according to the method of their production. However, water never dissolves more than a millionth pt. of its weight. (Bineau, *C. R.*, **41.** 510.) When moist it is readily soluble in aqueous solutions of caustic potash, soda, and ammonia, and of carbonate of ammonia; but after ignition it dissolves in them with difficulty. It is partially reprecipitated from its saturated solution in concentrated caustic ammonia, when this is diluted with water. Anhydrous oxide of zinc is soluble in concentrated, but insoluble in dilute, aqueous solutions of the caustic alkalies. The hydrated oxide, on the other hand, is very easily soluble, even in dilute alkaline liquors. (Fremy, *Ann. Ch. et Phys.*, (3.) **23.** 390.) On boiling the solution in potash for a considerable time, the oxide of zinc is completely reprecipitated, especially if the solution has been diluted with water. (H. Rose, *Tr.*) Its solubility in ammonia-water is greatly increased by the presence of traces of potash and ammonia salts, by most of the phosphates, by arsenic, chlorhydric, sulphuric, nitric, acetic, carbonic, tartaric, citric, and sulphurous acids; succinic and benzoic acids increase its solubility in ammonia-water only when this is very dilute; boracic, iodhydric, chloric, arsenic, oxalic, and gallic acids do not promote its solution in ammonia-water, but combine with it together with some ammonia. (Schindler.) Caustic ammonia does not produce any precipitate when added to strongly acid solutions. (H. Rose, *Tr.*) Soluble both when dry or recently precipitated in a boiling aqueous solution of chloride of ammonium. (Demarçay, *Ann. der Pharm.*, 1834, **11.** 251.) When recently precipitated it is soluble in a hot aqueous solution of chloride of ammonium (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97); a very free evolution of ammonia occurring when the mixture is boiled. (L. Thompson, *Ibid.*, p. 179.) Somewhat less soluble in a solution of nitrate of ammonia. (Brett, *Ibid.*, p. 97.) Somewhat soluble in an aqueous solution of waterglass (acid silicate of soda or potash). (Ordway, *Am. J. Sci.*, (2.) **32.** 338; compare *Ibid.*, **33.** 33.) Abundantly soluble in carbonic-acid water, from which it is precipitated by caustic alkalies, and partially by alkaline carbonates, though not by the bicarbonates. (Bergman, *Essays*, **1.** 50.) Anhydrous oxide of zinc is soluble in sulphurous acid. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 81.) Somewhat soluble in an aqueous solution of methylamin, but insoluble in a solution of amylamin. (A. Wurtz.) Soluble in an aqueous solution of oxide of stibmethylethylium. (Friedlænder.) Tolerably readily soluble in a boiling aqueous solution of cyanide of potassium. (Gore.) Soluble in an aqueous solution of cyanide of potassium. (F. & E. Rodgers, *Phil. Mag.*, 1834, (3.) **4.** 97.) Soluble in a boiling aqueous solution of nitrate of sesquioxide of iron, with precipitation of ferric oxide, and in a boiling solution of nitrate of lead, with formation of dinitrate of lead. Unacted upon by boiling solutions of the nitrates of cobalt, nickel, and cerium. (Persoz, *Chim. Moléc.*, pp. 365, 367, 368.) Insoluble in an aqueous solution of cane-sugar. (Peschier.) The presence of some non-volatile organic substances, like tartaric acid, hinders the precipitation of oxide of zinc from its solution, by means of the alkalies; but this effect is much less marked than with most other oxides. (H. Rose, *Tr.*)

*Per*Oxide of Zinc. Insoluble in water. Decomposed by acids. (Thénard.)

Oxide of Zirconium.
(*Zirconia.*)

a = *anhydrous.* After ignition it is insoluble in acids, excepting hot concentrated sulphuric acid. The best method of dissolving it is to reduce it to a fine powder and treat this with sulphuric acid which has been diluted with one part of water, and to heat the mixture gently in a platinum vessel until all the water has been evaporated, and then expel the excess of acid at a temperature below ignition. (Berzelius, *Lehrb.*, **2.** 187.)
$Zr_2 O_3$

b = *hydrated.* Insoluble in water, or alcohol. Hydrate of zirconium, even when moist, is only very sparingly soluble in sulphurous acid, and the portion dissolved is entirely reprecipitated on boiling the solution. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 76.) When precipitated from cold solutions it is readily soluble in acids, but when precipitated from hot solutions or washed with hot water, it dissolves only in concentrated acids after long-continued digestion at high temperatures. After having been dried, it is more difficultly soluble in acids than when moist.
$2\,Zr_2 O_3, 3\,H\,O$

Slowly, difficultly, and but slightly soluble in an aqueous solution of carbonate of ammonia. Insoluble in solutions of the fixed alkaline carbonates; but if the solution of a zirconium salt is precipitated by carbonate of potash or of soda, and an excess of either of these be added, the precipitate (carbonate of zirconia, *q. v.*) which at first forms is redissolved. Under these circumstances it is much more soluble in solutions of the alkaline bicarbonates than in the simple carbonates. Insoluble in solutions of the ammoniacal salts (excepting the carbonate as above), even when these are boiling. (Berzelius's *Lehrb.*, **2.** 188.) Insoluble in aqueous solutions of caustic potash, soda, or ammonia. Soluble in an aqueous solution of mixed tartrate of ammonia and caustic ammonia.

The presence of chloride of ammonium does not prevent its precipitation by the caustic alkalies, but this precipitation does not occur in the presence of non-volatile organic substances like tartaric acid. (H. Rose, *Tr.*)

OxIodic Acid. *Vid.* PerIodic Acid.

Oxuric Acid. (Probably impure Alloxanic Acid.) Very readily soluble in water, and alcohol. (Vauquelin.)

Oxurate of Ammonia. Soluble in water.

Oxurate of Lead. Somewhat soluble in water.

Oxurate of Lime.

I.) *normal.* Permanent. Soluble in more than 40 pts. of cold water; and in less hot water.

II.) *basic.* Sparingly soluble in cold, much more soluble in hot water.

Oxurate *of dinoxide* of Mercury. Ppt.

Oxurate of Potash. Soluble in water.

Oxurate of Silver. Somewhat soluble in water.

Oxurate of Soda. Soluble in water.

OxyAcanthin (from *Berberis vulgaris*). Almost insoluble in cold water. When recently precipitated it is sparingly soluble in boiling water. Easily soluble in alcohol, ether, and the fatty and essential oils. Soluble, with combination, in dilute mineral acids, but is decomposed by concentrated acids.
(*Berbin.*)

OxyAmmonide of *X*. *Vid.* AmmonioOxide of *X*.

OxyBenzoic Acid. Permanent. Sparingly soluble in cold, easily soluble in boiling water, and alcohol. Its alkaline salts are readily soluble in water; those of the alkaline earths are more difficultly soluble in water, while the other salts are insoluble in water, or alcohol. They are all soluble in acids. (Gerland, *Ann. Ch. u. Pharm.*, **91.** 189.)
(*Isomeric with Salicylic and Ampelic Acid.*)
$C_{14} H_6 O_6 = C_{14} H_5 O_5, H\,O$

OxyBenzoate of Lead.
$C_{14} H_5 Pb\,O_6$

OxyBromide of Antimony. Insoluble in water. (Serullas.)
(*Basic hydrobromate of Antimony*)

OxyBromide of Calcium. Decomposed by water.

OxyBromide of Cerium. Insoluble in water. (Dumas, *Tr.*)

OxyBromide of Copper. Insoluble in water. Decomposed by acids, even by carbonic acid. (Balard.)

OxyBromide *of sesquioxide* of Iron. *Vid.* Bromide of Iron (basic).

OxyBromide of Lead. Insoluble in water.
$Pb\,Br; Pb\,O$

OxyBromide *of protoxide* of Mercury. Insoluble in cold, sparingly soluble in hot water. Easily soluble in alcohol. (Lœwig.) Insoluble in alcohol. (Rammelsberg.)
$Hg\,Br; 3\,Hg\,O$

OxyBromide of Phosphorus. Slowly decomposed by water. (Ritter, *Ann. Ch. u. Pharm.*, **95.** 210.)
$P\,O_2\,Br_3$

OxyBromide of TellurEthyl.
$C_4 H_5 Te\,O; C_4 H_5 Te\,Br$

OxyBromide of Tungsten.
$W_2 O_5; W_2 Br_5$
$W\,Br_2\,O$ (Riche).

OxyChlorAmidide of Mercury. *Vid.* Chloride of *tetra*MercurAmmonium.

OxyChloride of Antimony. All the chlorine may be removed by the long-continued action of hot water (Malaguti); also by carbonic-acid water. Insoluble in an aqueous solution of cane-sugar. (Peschier.)
(*Powder of Algaroth.*)
$Sb\,Cl_5; 5\,Sb\,O_3$

OxyChloride of Bismuth. Totally insoluble in water. Almost entirely insoluble in very dilute chlorhydric acid; somewhat soluble in less dilute chlorhydric acid, from which it is again precipitated on the addition of water. (H. Rose, *Pogg. Ann.*, **83.** 145.) Soluble in hot nitric acid. (Jacquelin.)
$Bi\,Cl_3; 2\,Bi\,O_3$

OxyChloride of Calcium. Decomposed by water, and alcohol. (H. Rose.)
$Ca\,Cl; 3\,Ca\,O + 16\,Aq$

OxyChloride of Cerium. Insoluble in acids.

OxyChloride of Chromium.

I.) $Cr_2 O_2 Cl + Aq$ Deliquescent. Soluble in water when moist; but after having been dried at 120°, it dissolves very slowly in water. Very soluble in alcohol. (Péligot, *Ann. Ch. et Phys.*, (3.) **16**. 296.)

II.) $Cr_2OCl_2 + Aq$ [Compare *basic sesqui*Chloride of Chromium.]

OxyChloride of Citryl. *Vid.* OxyChloro-Citric Acid.

OxyChloride *of dinoxide* of Copper.
$Cu_2Cl; 2CuO$

OxyChloride *of protoxide* of Copper.
I.)
a = $CuCl; 2CuO$
b = *ditto* + Aq Soluble in a strong aqueous solution of protochloride of copper ($CuCl$); also in strong chlorhydric acid, not in excess. (Gladstone, *J. Ch. Soc.*, **8**. 214.)
c = *ditto* + 3 Aq & 4 Aq
II.)
a = $CuCl; 3CuO$
b = *ditto* + 4 Aq Insoluble in water. Easily soluble in acids.
c = *ditto* + 5 Aq Very slightly soluble in water. Soluble in ammonia-water. Soluble in chlorhydric and nitric acids, even when these are highly dilute. (F. Field, *J. Ch. Soc.*, **7**. 194.)
d = *ditto* + 6 Aq
III.) $CuCl; 4CuO$, & + 6 Aq Insoluble in water.

OxyChloride of Didymium. $DiCl; 2DiO + 3Aq$ Insoluble in water. Soluble in dilute acids. (Marignac, *Ann. Ch. et Phys.*, (3.) **38**. 161.)

OxyChloride of Ethene. *Vid.* Oxide of ChlorEthyl.

OxyChloride of Ethylidene. $C_8H_8Cl_2O_2$ Not decomposed by cold water, but is quickly decomposed on heating. (Lieben.)

OxyChloride of Gold. Soluble in water, and in an aqueous solution of caustic potash. (Fremy, *Ann. Ch. et Phys.*, (3.) **31**. 481.)

OxyChloride of Iridium. Ppt.

OxyChloride of Iron. *Vid. basic sesqui*Chloride of Iron.

OxyChloride of Lead.
I.) $3PbCl; PbO$ Swells up in water.
II.) $PbCl; PbO$
III.) $PbCl; 2PbO$ Easily soluble in acids.
IV.) $PbCl; 3PbO$ Almost insoluble in water. Slightly soluble in aqueous solutions of the caustic alkalies. Decomposed by acids. (Vauquelin.)
V.) $PbCl; 5PbO$
VI.) $PbCl$; 6 or 7 PbO(?) (*Cassel Yellow.*) Completely soluble in an aqueous solution of caustic potash. Nitric acid dissolves the oxide of lead, leaving the normal salt.

OxyChloride of Lime. *Vid.* OxyChloride of Calcium.

OxyChloride of Mercury (HgO).
(*Improperly ChloroMercurate of Mercury.*)
I.) $HgO; 2HgCl$ Somewhat soluble in water. (Roucher, *Ann. Ch. et Phys.*, (3.) **27**. 353.) Oxychloride of mercury is very sparingly soluble in water, but acquires the property of dissolving in considerable quantity when treated with solutions of the alkaline chlorides. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5**. 180.)
II.) $2HgO; HgCl$ Almost insoluble in water. Decomposed by boiling water; also by long-continued contact with cold water.
III.) $3HgO; HgCl$ Very sparingly soluble in cold, more soluble in hot water. (Guibourt; Donavan.) Decomposed by boiling water. (Millon.)
IV.) $4HgO; HgCl$ Does not appear to be decomposed by cold water when it is perfectly pure. Decomposed by a large quantity of boiling water. (Roucher, *loc. cit.*)
V.) $5HgO; HgCl$
VI.) $6HgO; HgCl + Aq$ Unacted upon by cold water.
VII.) $6HgO; HgCl$
[The reader should consult Roucher's original memoir cited above; compare also Millon, *Ann. Ch. et Phys.*, (3.) **18**. 387.]

OxyChloride of Molybdenum. $MbCl_2; MoO_2$(?) Very soluble in water.

OxyChloride of Nickel. $NiCl; NiO + Aq$ Sparingly soluble in water. (Berzelius.)

OxyChloride of Palladium. $3PdO, PdCl + 4Aq$ Insoluble in water. (Berzelius.) Soluble in acids. (Kane, *Phil. Trans.*, 1842, p. 282.)

OxyChloride of Phosphorus. *Vid.* Chlor-Oxide of Phosphorus.

OxyChloride of Platinum. $PtCl; 3PtO$ Insoluble in water. Appears to be soluble in a solution of caustic potash. Combines with ammonia-water, but is not dissolved thereby. Soluble in chlorhydric acid. (Kane, *Phil. Trans.*, 1842, p. 298.)

OxyChloride of SelenEthyl. $C_4H_5SeO; C_4H_5SeCl$ Soluble in water, and in absolute alcohol. (Joy.)

OxyChloride of Sulphide of Carbon. *Vid.* Sulphite of Chloride of *ter*ChloroMethyl.

OxyChloride of Sulphur. (*Hypochlorosulphuric compound.*) $S_2O_8Cl_2$ Exists under two modifications; one of which (crystalline) is decomposed with extreme violence by water, alcohol, and dilute acids. The other (liquid) is insoluble in water, alcohol, or weak acids, and is only slowly decomposed by them. (Millon, *Ann. Ch. et Phys.*, (3.) **29**. 238.)

OxyChloride of TellurEthyl. $C_4H_5TeO; C_4H_5TeCl$ Sparingly soluble in cold water; much more readily soluble in ammonia-water. Soluble in boiling, less soluble in cold alcohol. (Wœhler.)

OxyChloride of TellurMethyl. $C_2H_3TeO; C_2H_3TeCl$ Soluble in alcohol. (Wœhler & Dean.)

OxyChloride of Thorium. Decomposed by water.

OxyChloride of Tin. $SnCl; SnO + 3Aq$ Insoluble in water. Soluble in an aqueous solution of caustic potash, from which solution metallic tin separates after a time. (Berzelius.) Soluble in chlorhydric, acetic, dilute nitric and sulphuric acids. (J. Davy.)

OxyChloride of Tungsten.
I.) WCl_2O Immediately decomposed by water. (Riche.)

II.) $W\,Cl\,O_2$ Slowly decomposed by water. (Riche.)

OxyChloride of Zinc. Insoluble in water. $Zn\,Cl; 9\,Zn\,O$ Somewhat soluble in ammonia-water. Easily soluble in acids. (Schindler.)

OxyChloride of Zirconium. *Vid.* *Sesqui*-Chloride of Zirconium(*basic*).

OxyChloroCarbonate of Methylene. *Vid.* ChloroCarbonate of Methyl.

OxyChloroCarbonic Ether. *Vid.* Chloro-Carbonate of Ethyl.

OxyChloroCitric Acid. Deliquesces, with (*Oxychloride of Citryl.*) $C_{12}\,H_8\,O_{12}\,Cl_2$ decomposition. Decomposed by most of the common solvents, the only liquid by which it can be washed and freed from mother-liquor being (with the possible exception of benzin) bisulphide of carbon, in which it is insoluble, or very sparingly soluble. (Pebal, *Ann. Ch. u. Pharm.*, 1856, **98.** 72.)

OxyChloroNaphthalenose. Insoluble in $C_{18}\,H_8\,Cl_6\,O_2$? water. Slightly soluble in alcohol, and ether. Soluble in concentrated sulphuric acid. (Laurent.)

OxyCobaltiCyanide of Lead. Insoluble $Pb_3\,Co_2\,Cy_6, 6\,Pb\,O, 3\,H\,O$ in water. Soluble in acids. (Zwenger.)

OxyCopaivic Acid. See Resins of Copaiba, under Resins.

OxyCuminic Acid. Sparingly soluble in $C_{20}\,H_{12}\,O_6$ cold, more soluble in boiling water; more readily soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 338.)

OxyCuminate of Silver.
$C_{20}\,H_{11}\,Ag\,O_6$

OxyCyanide of Lead. Ppt.
$Pb\,Cy; 2\,Pb\,O$

OxyCyanide of Mercury.

I.) $Hg\,Cy; Hg\,O$ Sparingly soluble in cold, tolerably easily soluble in boiling water. (Schlieper; Johnston.) Somewhat soluble in spirit. (Kuehn.) Soluble, with decomposition, in aqueous solutions of caustic potash, chloride of potassium, and cyanide of potassium. (Johnston.) Decomposed by acids.

II.) $Hg\,Cy; 3\,Hg\,O$ Somewhat more soluble in water than the normal cyanide of mercury. (Kuehn.)

OxydoChloride of *X*. *Vid.* OxyChloride of *X*.

OxyFluoride of Antimony. Permanent.
$Sb\,O_3; Sb\,Fl_3$

OxyFluoride of Cobalt. Insoluble in $2(Co\,O; Co\,Fl) + Aq$ water. (Berzelius.)

OxyFluoride of Copper. Insoluble in $Cu\,Fl; Cu\,O + Aq$ water. (Berzelius.)

OxyFluoride of Lead. Soluble in water. [Insoluble in aqueous solutions of the alkaline fluorides ?]

Oxygen. 100 vols. of water absorb 4.6 vols. of O oxygen gas at the ordinary temperature; hence 1 kilogrm. of water contains 0.0464 grm. of oxygen. (Otto-Graham.) Soluble in 27 pts. of water at the ordinary temperature. (Pelouze & Fremy.) 100 vols. of water dissolve 0.925 vol. of oxygen. (Gay-Lussac, cited by Fernet, *Ann. Ch. et Phys.*, (3.) **47.** 360.) 100 vols. of arterial blood dissolve from 10 to 13 vols. of oxygen. (Magnus.)

1 vol. of water, under a pressure of $0^m.76$ of mercury, at °C.	Dissolves of oxygen gas, — vols., reduced to 0°C. and $0^m.76$ pressure of mercury.
0°	0.04114
1°	0.04007
2°	0.03907
3°	0.03810
4°	0.03717
5°	0.03628
6°	0.03544
7°	0.03465
8°	0.03389
9°	0.03317
10°	0.03250
11°	0.03189
12°	0.03133
13°	0.03082
14°	0.03034
15°	0.00289
16°	0.02949
17°	0.02914
18°	0.02884
19°	0.02858
20°	0 02838

(Bunsen's *Gasometry*, pp. 286, 128, 153.)

1 vol. of alcohol under a pressure of $0^m.76$ of mercury at any temperature from 0° to 24° C. dissolves 0.28397 vol. of oxygen gas, reduced to 0° and $0^m.76$ pressure of mercury. (Bunsen's *Gasometry*, pp. 286, 128, 158.) 100 vols. of water at 18° dissolve 6.5 vols. of it. 100 vols. of alcohol, of 0.84 sp. gr., at 18° dissolve 16.25 vols. of it. (Th. de Saussure, *Gilbert's Ann. Phys.*, 1814, **47.** 167.) Insoluble in ether. (Dœbereiner.) Abundantly absorbed by oil of turpentine. The oil, in the course of a fortnight's exposure to the air, absorbs its own volume of oxygen, but does not give it off again on boiling. (Brandes.) 1 vol. of oil of turpentine took up in 4 months 20 vols. of oxygen; in 9 months more, 27.2 vols.; in the tenth month, at a temperature of 18° to 20°, somewhat more than 1 vol. daily; but in the following 33 months, only 9 vols. more; making the quantity of oxygen absorbed in the whole 43 months 128 vols. (Saussure, *Gm.*, **14.** 247.) Oil of turpentine in absorbing oxygen acquires new properties, being converted into "ozonized oil of turpentine"; in which compound part of the absorbed oxygen appears to be more intimately, a second portion (amounting to 5.2% of the oil) less intimately combined, inasmuch as the latter may be transferred to other bodies, and still exhibit the properties of free ozone. (Schœnbein.) The formation of ozonized oil of turpentine takes place on agitating the oil with cold air in presence of light, the action going on the more quickly, the more numerous the points of contact of the oil and the air, the brighter the light, and the lower the temperature. (*Gm.*, **14.** 256.) It is absorbed in large quantities at the ordinary temperature by oil of lavender, carbonic acid being given off meanwhile. At 24° oil of lavender absorbed the following quantities of oxygen: In the first 12 hours, none; in the two following days, 1.39 vols. daily; in the following week, 6.17 vols. daily; altogether in 4½ months, 111 vols.; in the following 30 months, 8 vols.; therefore, in 34½ months, 119 vols.; in the same interval 22.1 vols. of carbonic acid were formed and the oil became somewhat yellowish. Kept over mercury in the shade during four winter months, below 12°, it absorbed 52 vols. of oxygen, 2 vols. of carbonic acid being formed.

(Saussure, *Gm.*) Oxygen is absorbed by oil of lemon, whilst carbonic acid, nitrogen, and hydrogen go off. In a week the oil absorbed 0.8 vol.; in the two following months, as a daily average, 1 07 vols.; after four weeks at 23°, daily 1.7 vols.; within a year 141.7 vols.; in the following 30 months scarcely 2 vols.; and yielded 16.6 vols. of carbonic acid, 0.66 vol. nitrogen, and 0.29 vol. hydrogen. (Saussure, *Gm.*, **14.** 298.) 1 vol. of caoutchin absorbs in 14 days, 45 vols. of oxygen, without becoming saturated; in 3 weeks, at 20°, it absorbs 2 vols. of oxygen.

Many metallic oxides are soluble in water; several of them are soluble in alcohol.

None of the protoxides, excepting, perhaps, protoxide of uranium, loses its solubility in acids by exposure to a red heat. Most of the protoxides (like $Mg O$) form only insoluble *basic* salts, while the sesquioxides (like $Al_2 O_3$) enter into numerous gum-like soluble sub-acid combinations. (Ordway, *Am. J. Sci.*, (2.) **26.** pp. 206, 208.) Many salts of the metallic oxides are soluble in ether, though fewer than in alcohol.

OxyGuanin. $C_{10} H_7 N_4 O_9$ Insoluble in water, alcohol, or ether. Unacted upon by cold chlorhydric, phosphoric, acetic, oxalic, and dilute sulphuric acids; but is in part dissolved by them when warm, separating out again for the most part as the solutions cool. Soluble, without decomposition, in an excess of nitric acid. Easily soluble in aqueous solutions of caustic potash, soda, ammonia, lime, and baryta. Insoluble in solutions of the alkaline carbonates; but sparingly soluble in solutions of the alkaline bicarbonates. (Kerner, *Ann. Ch. u. Pharm.*, **103.** 253.)

OxyIodide of Antimony. (*Basic Hydriodate of Antimony.*) $Sb I_3 ; 5 Sb O_3$ Insoluble in water. Decomposed by long-continued washing with hot water, or solutions of the caustic or carbonated alkalies. (Serullas.)

OxyIodide of Bismuth.

I.) $Bi I_3 ; 2 Bi O_3$ Completely insoluble in water. Insoluble in aqueous solutions of the iodides or chlorides of potassium and of sodium. Very incompletely decomposed by a solution of caustic potash, even when this is boiling; more easily and completely decomposed by a boiling solution of carbonate of ammonia. (Arppe, in *Berzelius's Lehrb.*)

II.) $2 Bi I_3; 5 Bi O_3$ Behaves like No. I. Somewhat soluble in tartaric acid, and in a solution of bitartrate of potash. Easily soluble in chlorhydric acid, and in solutions of sulphide of ammonium and caustic potash. Decomposed by nitric acid, with separation of oxide. Only slowly acted upon by sulphuric acid.

OxyIodide of Cadmium. Insoluble in water.

OxyIodide of Cobalt. Insoluble in water. $Co I; Co O$ (Rammelsberg.)

OxyIodide of Lead.

I.) $Pb I ; Pb O$ Insoluble in boiling water. (Caventou; Brandes); or in boiling ether. (Vogel.) Decomposed by acetic acid. (Brandes; Denot.) Unaltered by a solution of iodide of potassium. (Brandes.)

II) $Pb I ; 2 Pb O$ Insoluble in boiling water.

III) $Pb I ; 3 Pb O + 2 Aq$

IV.) $Pb I ; 5 Pb O$ Insoluble in boiling water.

OxyIodide of *di*Mercur(*ic*)ammonium. $N \left\{ \begin{matrix} H_2 \\ 2 Hg \end{matrix} \right. . I; 2 Hg O$ Permanent. Soluble in chlorhydric acid. Insoluble in ammonia-water.

OxyIodide of Mercury. $Hg I ; 3 Hg O$ Decomposed by water. Soluble in iodhydric acid.

OxyIodide of Nickel. $Ni I ; 9 Ni O + 15 Aq$ Insoluble in water, or ammonia-water. Decomposed by boiling alcohol, and by a boiling aqueous solution of caustic potash. Soluble in acetic acid.

OxyIodide of TellurEthyl. $C_4 H_5 Te I ; C_4 H_5 Te O$ Sparingly soluble in water. Readily soluble in ammonia-water.

OxyIodide of Zinc. $Zn I, 3 Zn O + 2 Aq$ Insoluble in cold, slightly soluble in boiling water. (Millon, in *Berzelius's Lehrb.*, **3.** 676.)

OxyMethylene. $C_4 H_4 O_4$ Insoluble in water, alcohol, or ether, when merely boiled with them, but when heated with water to 100° in a sealed tube for several hours it dissolves completely without alteration. (Butlerow.)

OxyMuriatic Acid. *Vid.* Chlorine.

OxyNaphtylamin. *Vid.* Naphtamein.

OxyPeucedanin. Insoluble in cold ether. $C_{14} H_{11} O_7$ (Erdmann.)

OxyPhenic Acid. (*BinOxide of Phenyl. PyroCatechine. PyroCatechucic Acid. PyroMorinTannic Acid.*) $C_{12} H_6 O_4 = C_{12} H_4 O_2, 2 H O$ Readily soluble in water, alcohol, and (when the acid has been prepared from pyroligneous acid) also in ether. (Buchner, *Ann. Ch. u. Pharm.*, **96.** 189.) Readily soluble in water; still more soluble in alcohol; but very sparingly soluble in ether. (Zwenger.) Very sparingly soluble in ether. (Buchner.) Easily soluble in water, alcohol, and ether. (Reinsch.) Soluble in concentrated sulphuric, and chlorhydric acids. (Zwenger.)

OxyPhenate of Lead. $C_{12} H_4 Pb_2 O_4$ Permanent. Nearly insoluble in water. Readily soluble in acetic acid. (Zwenger.)

OxyPicric Acid. (*Styphnic Acid. Artificial Tannin. Artificial Bitter.*) $C_{12} H_3 N_3 O_{16} = C_{12} H (N O_4)_3 O_2, 2 H O$ Soluble in 104 pts. of water at 25° (Erdmann); in 88 pts. of water at 62°. (Bœttger & Will.) More easily soluble in alcohol, and ether. (B. & W.) More readily soluble in strong acetic acid than in water. Easily soluble in concentrated nitric acid; less soluble in strong chlorhydric acid. On the addition of water it is partially precipitated from both of these solutions. (B. & W.)

OxyPicrate of Ammonia.

I.) *normal.* $C_{12} H (N H_4)_2 (N O_4)_3 O_4$ More soluble in water than the monobasic salt. Less soluble in an aqueous solution of carbonate of ammonia than in pure water.

II.) *acid.* $C_{12} H_2 (N H_4) (N O_4)_3 O_4$ Less soluble in water than the normal salt.

OxyPicrate of Ammonia & of Cobalt.

OxyPicrate of Ammonia & *of protoxide* of Copper. $C_{12} H (N H_4) Cu (N O_4)_3 O_4 + 8 Aq$ Tolerably soluble in water. (Bœttger & Will.)

OxyPicrate of Baryta.

I.) *normal.* Very sparingly soluble in water. $C_{12} H Ba_2 (N O_4)_3 O_4 + 4 Aq$

OxyPicrate of Cadmium.

OxyPicrate of Cobalt. Readily soluble in water. (Bœttger & Will.)
$C_{12}\,H\,Co_2\,(N\,O_4)_3\,O_4 + 8\,Aq$

OxyPicrate of Cobalt & of Potash.
$C_{12}\,H\,Co\,K\,(N\,O_4)_3\,O_4 + 2\,Aq$

OxyPicrate *of protoxide* **of Copper.**
I.) *normal.* Soluble in water. (Bœttger & Will.)
$C_{12}\,H\,Cu_2\,(N\,O_4)_3\,O_4 + 9\,Aq$

OxyPicrate of Copper & of Potash.
$C_{12}\,H\,Cu\,K\,(N\,O_4)_3\,O_4 + 4\,Aq$

OxyPicrate *of protoxide* **of Iron.** Readily soluble in water. Readily alterable.

OxyPicrate *of sesquioxide* **of Iron.**

OxyPicrate of Lead.
I.) *basic.* Almost insoluble in water. (Bœttger & Will.)
$C_{12}\,H_2\,Pb\,(N\,O_4)_3\,O_4,\ 2\,Pb\,O + 3\,Aq$

OxyPicrate of Lime.
I.) *normal.* Very soluble in water.
$C_{12}\,H\,Ca_2\,(N\,O_4)_3\,O_4 + 7\,Aq$

OxyPicrate of Magnesia. Very readily soluble in water.

OxyPicrate of Manganese.
II.) *acid* Very easily soluble in water.
$C_{12}\,H_2\,Mn\,(N\,O_4)_3\,O_4 + 12\,Aq$

OxyPicrate of Nickel. Very readily soluble in water. (Bœttger & Will.)

OxyPicrate of Nickel & of Potash. Difficultly soluble in water.
$C_{12}\,H\,Ni\,K\,(N\,O_4)_3\,O_4 + 4\,Aq$

OxyPicrate of Potash.
I.) *normal.* Soluble in 58 pts. of water at 23°; much less soluble in water containing caustic potash or carbonate of potash. (Erdmann.)
$C_{12}\,H\,K_2\,(N\,O_4)_3\,O_4 + Aq$
II.) *acid.* Soluble in water.
$C_{12}\,H_2\,K\,(N\,O_4)_3\,O_4 + 2\,Aq$

OxyPicrate of Silver.
I.) *normal.* Sparingly soluble in water; on boiling, the aqueous solution is decomposed. (Bœttger & Will.)
$C_{12}\,H\,Ag_2\,(N\,O_4)_3\,O_4 + 2\,Aq$

OxyPicrate of Soda.
I.) *normal.* Readily soluble in water. (Bœttger & Will.)
$C_{12}\,H\,Na_2\,(N\,O_4)_3\,O_4 + 5\,Aq$
II.) *acid.*

OxyPicrate of Strontia.
I.) *normal.* More readily soluble than the baryta salt. (Bœttger & Will.)
$C_{12}\,H\,Sr_2\,(N\,O_4)_3\,O_4 + 4\,Aq$

OxyPicrate of Urea.
$2\,C_2\,H_4\,N_2\,O_2,\ C_{12}\,H_2\,N_3\,O_{15}$

OxyPicrate of Zinc. Deliquescent. Is the most soluble of any of the oxypicrates.

OxyPinitannic Acid. Readily soluble in water. (Kawalier.)
$C_{14}\,H_8\,O_9$

OxyPinitannate of Lead. Ppt.

OxyPorphyric Acid.

OxyPorphyrate of Ammonia. Readily soluble in an aqueous solution of carbonate of ammonia.

"OxyProtein." Insoluble in water.
(*Bin Oxide of Protein.*)

OxyPyrolic Acid. Soluble in 42 pts. of water at 20°; much more soluble in boiling water. Soluble in alcohol. (Arppe, *Ann. Ch. u. Pharm.*, **95.** 248.)
$C_{14}\,H_{12}\,O_{10} = C_{14}\,H_{10}\,O_8,\ 2\,H\,O$

OxyPyrolate of Baryta. Tolerably soluble in water.

OxyPyrolate of Silver.
$C_{14}\,H_{10}\,Ag_2\,O_{10}$

OxyPyrolate of Soda.

OxySelenide of Antimony.

OxySulphide of Ammonium & of Uranium.
$N\,H_4\,S,\ 2\,Ur_2\,S_3\,;\ 21\,(N\,H_4\,O,\ 2\,Ur_2\,O_3 + 3\,Aq)$ Ppt.

OxySulphide of Antimony. Chlorhydric and tartaric acids dissolve out the oxide, leaving the sulphide of antimony undissolved.
$Sb\,O_3\,;\ 2\,Sb\,S_3$

OxySulphide of Barium.
I.) $Ba\,O,\ 10\,H\,O\,;\ 3\,(Ba\,S,\ 6\,H\,O)$
II.) $Ba\,O,\ 10\,H\,O\,;\ Ba\,S,\ 10\,H\,O$
III.) $4\,(Ba\,O,\ 10\,H\,O);\ 3\,(Ba\,S,\ 6\,H\,O)$

Decomposed by boiling water, hydrate of baryta crystallizing out as the solution cools. (H. Rose.)

OxySulphide of Calcium. Decomposed by much water (H. Rose.) Soluble in 400 pts. of cold water; decomposed by boiling water. (Buchner.) Insoluble in alcohol. (Gm.) Soluble in alcohol. (Gay-Lussac.) Permanent in dry air. Very sparingly soluble in cold water. Hot water dissolves a much larger portion, but does not deposit it on cooling. An aqueous solution saturated at 0° @ 7.2° was of 1.0105 sp. gr. (Herschel, *Edin. Phil. Journ.*, 1819, **1.** 12.)
$5\,Ca\,O,\ Ca\,S_5 + 20\,Aq$

OxySulphide of Cobalt Cold chlorhydric acid dissolves out only the oxide of cobalt; but hot chlorhydric acid decomposes it entirely.
$Co\,O\,;\ Co\,S$

OxySulphide of Cyanogen. *Vid.* PerSulphoCyanogen.

OxySulphide of Didymium. Insoluble in water. Soluble in dilute chlorhydric acid, with decomposition. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 158.)
$Di\,O_2\,;\ Di\,S$

OxySulphide of Manganese. Permanent. Soluble in acids, with decomposition. (Arfvedson.)
$Mn\,O\,;\ Mn\,S$

OxySulphide of Zinc. Soluble, with decomposition, in chlorhydric acid.

OxySulphoCarbonic Acid. Unknown.
(*Di Sulpho Carbonic Acid*(of Gerhardt).
Carbonyl Sulfosæure(of Weltzien).)
$C_2\,H_2\,S_4\,O_2 = \left.\begin{matrix}H\,O\\H\,O\end{matrix}\right\}C_2\,S_4$ or $\left.\begin{matrix}C_2\,O_2''\\H_2\end{matrix}\right\}S_4$

OxySulphoCarbonate of Allyl.
(*Allyl Xanthic Acid.*)
$C_8\,H_6\,S_4\,O_2 = C_2\,H\,(C_6\,H_5)\,S_4\,O_2$

OxySulphoCarbonate of Allyl & of Potassium.
$C_2\,K\,(C_6\,H_5)\,S_4\,O_2$

OxySulphoCarbonate of Ammonium & of Amyl. Soluble in water; the solution subsequently undergoing gradual decomposition. Soluble in alcohol and in ether. (M. W. Johnson, *J. Ch. Soc.*, **5.** pp. 143, 148.)
(*Amyl Xanthogenamate of Ammonia.*
Amyldi Sulpho Carbonate of Ammonia.)
$C_2\,(N\,H_4)\,(C_{10}\,H_{11})\,S_4\,O_2$

OxySulphoCarbonate of Ammonium & of Ethyl. Very soluble in water, and alcohol. (Zeise.) Insoluble in ether.
(*Ethyl di Sulpho Carbonate of Ammonia.*)
$C_2\,(N\,H_4)\,(C_4\,H_5)\,S_4\,O_2$

OxySulphoCarbonate of Amyl.
(*Amyl di Sulpho Carbonic Acid. Amyl-Ory Sulpho Carbonic Acid. Amylo-Xanthic Acid. Xanthamylic Acid.*)

I.) $C_{12}\,H_{12}\,O_2\,S_4 = \left.\begin{matrix}C_{10}\,H_{11}\,O\\ H\,O\end{matrix}\right\}C_2\,S_4$; or $\left.\begin{matrix}C_2\,O_2''\\ H\,.\,C_{10}\,H_{11}\end{matrix}\right\}S_4$ Soon decomposed by water. Insoluble in an aqueous solution of chloride of potassium.

II.) $C_{22}\,H_{22}\,O_2\,S_4 = C_2\,(C_{10}\,H_{11})_2\,S_4\,O_2$

OxySulphoCarbonate of Amyl & of Copper. Ppt.

OxySulphoCarbonate of Amyl & of Ethyl. $C_2\,(C_{10}\,H_{11})\,(C_4\,H_5)\,S_4\,O_2$ Decomposed by concentrated ammonia-water.

OxySulphoCarbonate of Amyl & of Lead. $C_2\,(C_{10}\,H_{11})\,Pb\,S_4\,O_2$ Ppt. (Balard, *loc. cit.*) Soluble in alcohol. (Johnson.)

OxySulphoCarbonate of Amyl & of Manganese. Ppt. (Balard.)

OxySulphoCarbonate of Amyl & of Methyl. $C_2\,(C_{10}\,H_{11})\,(C_2\,H_3)\,S_4\,O_2$

OxySulphoCarbonate of Amyl & of Potassium. $C_2\,(C_{10}\,H_{11})\,K\,S_4\,O_2$ Soluble in water. More soluble in hot than in cold alcohol. Somewhat soluble in ether. (Balard, *Ann. Ch. et Phys.*, (3.) **12.** 307.) Only slightly soluble in anhydrous ether. (Kolbe's *Lehrb.*, **1.** 322.)

OxySulphoCarbonate of Amyl & of Silver. Ppt.

"*Bin*OxySulphoCarbonate of Amyl." *Vid.* SulphoCarbonidate of Amyl.

OxySulphoCarbonate of Baryta & of Ethyl. (*EthyldiSulpho Carbonate of Baryta*) $C_2\,Ba\,(C_4\,H_5)\,S_4\,O_2 + 2\,Aq$ Soluble in water, and alcohol. (Zeise.)

OxySulphoCarbonate of Cetyl. (*CetyldiSulphoCarbonic Acid.*) $C_{34}\,H_{34}\,O_2\,S_4 = C_2\,H\,(C_{32}\,H_{33})\,S_4\,O_2$ Most of its compounds, with metallic bases, are insoluble in alcohol. (De la Provostaye & Desains, *Ann. Ch. et Phys.*, (3.) **6.** 500.)

OxySulphoCarbonate of Cetyl & of Lead. Ppt., in alcohol.

OxySulphoCarbonate of Cetyl & of Mercury(Hg). Ppt., in alcohol.

OxySulphoCarbonate of Cetyl & of Potash. $C_2\,K\,(C_{32}\,H_{33})\,S_4\,O_2$ Insoluble in water, which, however, tends to decompose it. Very abundantly soluble in warm, but only sparingly soluble in cold alcohol, and ether. (Provostaye & Desains, *Ibid.*, p. 495.)

OxySulphoCarbonate of Cetyl & of Silver. Ppt., in alcohol.

OxySulphoCarbonate of Cetyl & of Zinc. Ppt., in alcohol.

OxySulphoCarbonate of Copper(Cu_2) & of Ethyl. $C_2\,Cu_2\,(C_4\,H_5)\,S_4\,O_2$ Insoluble in water, alcohol, or ether. Not sensibly soluble in ammonia-water. (Zeise.)

OxySulphoCarbonate of Ethyl. (*EthyldiSulpho Carbonic Acid. Xanthogenic Acid. Xanthic Acid.*)

I.) $C_2\,H\,(C_4\,H_5)\,S_4\,O_2$ Very sparingly soluble in water. Miscible in all proportions with caoutchin. (Himly.) The alkaline salts of this compound are soluble in water. (Zeise.)

II.) $C_2\,(C_4\,H_5)_2\,S_4\,O_2$ (*Xanthic Ether. Xanthelene. DiSulphoCarbonate of Ethyl.*) Insoluble in water. Miscible in all proportions with alcohol, and ether. (Zeise, *Ann. Ch. et Phys.*, (3.) **17.** 341; and (3.) **20.** 124. Debus.)

OxySulphoCarbonate of Ethyl & of Lead. (*EthyldiSulphoCarbonate of Lead.*) $C_2\,(C_4\,H_5)\,Pb\,S_4\,O_2$ Permanent. Soluble in water. (Laurent, *Method*, p. 250.) Insoluble in cold water, but is slowly decomposed by boiling with water. Tolerably soluble in warm, less soluble in cold alcohol. Insoluble in ether. (Zeise; Courbe.) Boiling acetic acid has no action upon it, and it is scarcely at all attacked by dilute sulphuric acid.

OxySulphoCarbonate of Ethyl & of Lime. Soluble in alcohol. (Zeise.)

OxySulphoCarbonate of Ethyl & of Mercury(Hg). Soluble in a solution of oxysulphocarbonate of ethyl and of potash.

OxySulphoCarbonate of Ethyl & of Methyl. $C_2\,(C_4\,H_5)\,(C_2\,H_3)\,S_4\,O_2$ Insoluble in water. Easily soluble in alcohol, and ether. (Chancel, in *Gerhardt's Tr.*, **1.** 182.)

OxySulphoCarbonate of Ethyl & of Potash. (*EthyldiSulphoCarbonate of Potash. Xanthate of Potash.*) $C_2\,(C_4\,H_5)\,K\,S_4\,O_2$ Readily soluble in water, and alcohol. The aqueous solution is decomposed when heated above 50°. Soluble in 5 @ 6 pts. of absolute alcohol; and this solution is not decomposed by boiling, unless 8% or more of water be present. Very sparingly soluble in ether. Insoluble in naphtha. (Zeise.)

OxySulphoCarbonate of Ethyl & of Silver. Soluble in water. (Laurent, in his *Method*, p. 250.)

OxySulphoCarbonate of Ethyl & of Soda. $C_2\,(C_4\,H_5)\,Na\,S_4\,O_2$ Soluble in water, and alcohol. (Zeise.)

OxySulphoCarbonate of Ethyl & of Zinc. Sparingly soluble in water; more readily soluble in dilute alcohol. (Zeise.)

OxySulphoCarbonate of Methyl.

I.) (*MethyldiSulpho Carbonic Acid. SulphoCarboMethylic Acid. Methyl-Xanthic Acid.*) $C_2\,H\,(C_2\,H_3)\,S_4\,O_2$ Not isolated.

II.) (*MethylXanthic Ether. DiSulphoCarbonate of Methyl. SulphoCarboMethylic Ether.*) $C_2\,(C_2\,H_3)_2\,S_4\,O_2$ Insoluble in water. Abundantly soluble in alcohol, and ether. (Zeise, *Ann. Ch. et Phys.*, (3.) **20.** 122.)

OxySulphoCarbonate of Methyl & of Lead. $C_2\,(C_2\,H_3)\,Pb\,S_4\,O_2$

OxySulphoCarbonate of Methyl & of Potassium. $C_2\,(C_2\,H_3)\,K\,S_4\,O_2$ Soluble in wood-spirit. (Dumas & Peligot.)

"*Bin*OxySulphoCarbonate of Methyl." $C_4\,H_3\,S_4\,O_2$ *Vid.* SulphoCarbonidate of Methyl.

OxySulphoCarbonate of Potassium & of Propyl. $C_2\,(C_6\,H_7)\,K\,S_4\,O_2$

*Bin*OxySulphoCarbonate of *X*. *Vid.* SulphoCarbonidate of *X*.

OxySulphoCyanate of Ethyl. $C_{12}\,H_{10}\,N_2\,S_2\,O_4$ Easily soluble in water, and alcohol, though less readily in the former than in the latter. (Debus.)

OxySulphoCyanide of *X*. *Vid. basic*SulphoCyanide of *X*.

OxySulphuret of *X*. *Vid.* OxySulphide of *X*.

OxyXanthic Acid. *Vid.* EthylSulphoCarbonic Acid.
$C_6 H_6 S_2 O_4$

OxyThymoyl. Insoluble in water or alcohol. Very sparingly soluble in ether. Insoluble in aqueous alkaline solutions. (Lallemand, *Ann. Ch. et Phys.*, (3.) **49.** 167.)
$C_{24} H_{16} O_6$

Ozokerite. Contains several different substances, some of which are soluble in boiling alcohol, while others are insoluble therein.
(*A fossil resin.*)
$C_{40} H_{40}''(?)$

P.

Palladium. Slowly soluble in boiling concentrated sulphuric acid. Gradually soluble in chlorhydric acid, when in contact with the air. Somewhat difficultly soluble in nitric acid (more rapidly if it contain nitrous acid); and in aqua-regia at the ordinary temperature.
Pd

Palladium is more readily soluble in acids than any of the other so-called platinum metals; dissolving, though with difficulty, in concentrated nitric acid, and with extreme ease in aqua-regia. (Claus, *Beiträge*, p. 37.) Somewhat soluble in concentrated, but not in dilute iodhydric acid. (H. Rose, *Tr.*) Palladium is feebly attacked by iodhydric acid, hydrogen being disengaged. (H. Deville, *C. R.*, 1856, **42.** 896.)

Palmic Acid. *Vid.* Ricinelaidic Acid.

Palmin. *Vid.* Ricinelaidin.

Palmitic Acid. Insoluble in water. Soluble in hot, sparingly soluble in cold alcohol. Very soluble in ether. Soluble in hot concentrated sulphuric acid, from which solution it is precipitated on the addition of water. (Maskelyne, *J. Ch. Soc.*, **8.** 5.) Insoluble in water. Soluble in all proportions in alcohol of 0.820, at 50°, separating cut in part as the solution cools. Extremely soluble in ether. Also soluble in a mixture of alcohol and ether. (Lawrence Smith, *Ann. Ch. et Phys.*, (3.) **6.** pp. 45, 52.) Its alkaline salts are soluble in water.
(*Ethalic Acid. Cetylic Acid. Olidic Acid.*)
$C_{32} H_{32} O_4 = C_{32} H_{31} O_3, H O$

Palmitate of Ammonia. Insoluble in cold water.

Palmitate of Amyl. Soluble in ether.
$C_{32} H_{31} (C_{10} H_{11}) O_4$

Palmitate of Baryta. Insoluble, or very sparingly soluble in water, or alcohol. (Maskelyne, *J. Ch. Soc.*, **8.** 8.)
$C_{32} H_{31} Ba O_4$

Palmitate of Cetyl. Insoluble in water. Soluble in 40 pts. of boiling alcohol, of 0.821 sp. gr., and in 7 pts. of boiling absolute alcohol. Also soluble in hot ether, separating out again for the most part as the solution cools, in wood-spirit, and the fatty and essential oils. Somewhat difficultly saponified by potash.
(*Spermaceti. Cetin. Ethalate of Ethal. Cetylate of Cetyl.*)
$C_{32} H_{31} (C_{32} H_{33}) O_4$

100 pts. of boiling alcohol, of 0.821 sp. gr. dissolve 2.5 pts. of it, the greater part being deposited again as the solution cools; more soluble in absolute alcohol, and in ether, also in oil of turpentine, the fatty oils, benzin, chloroform, lignone, creosote, coal-oils, &c.

Palmitate of Copper. Ppt.
$C_{32} H_{31} Cu O_4$

Palmitate of Ethyl. Insoluble in water. Soluble in alcohol. (Maskelyne, *J. Ch. Soc.*, **8.** 11.)
(*Ethalic Ether.*)
$C_{32} H_{31} (C_4 H_5) O_4$

Palmitate of Glyceryl. *Vid.* Palmitin.

Palmitate of Glycocoll. Soluble in hot, less soluble in cold spirit. (Horsford, *Am. J. Sci.*, (2.) **4.** 63.)
$C_{32} H_{31} (C_4 H_5 N O_4) O_4 + 10 Aq$

Palmitate of Lead. Insoluble, or very sparingly soluble in water, or alcohol. (Maskelyne, *J. Ch. Soc.*, **8.** 9.) Insoluble in cold ether. (Lawrence Smith, *Ann. Ch. et Phys.*, (3.) **6.** 42.)
$C_{32} H_{31} Pb O_4$

Palmitate of Lime. Insoluble in water, or ether. Slightly soluble in warm alcohol of 0.820. (Lawrence Smith, *Ann. Ch. et Phys.*, (3.) **6.** 42.) Insoluble in ether. (Shueler.)

Palmitate of Magnesia. Insoluble, or very sparingly soluble in water or alcohol. (Maskelyne, *J. Ch. Soc.*, **8.** 9.) Soluble in boiling alcohol, from which it separates almost completely on cooling.
$C_{32} H_{31} Mg O_4$

Palmitate of Methyl.
$C_{32} H_{31} (C_2 H_3) O_4$

Palmitate of Myricyl. Insoluble in cold alcohol. Easily soluble in ether. Soluble in creosote. Soluble in 200 pts. of boiling alcohol; and in 99 pts. of cold ether. Easily soluble in oil of turpentine. Soluble in naphtha. (Wittstein's *Handw.*)
(*Myricin.*)
$C_{32} H_{31} (C_{60} H_{61}) O_4$

Palmitate of Potash. Soluble in a small quantity of water. Decomposed by much water. Completely soluble in alcohol. Insoluble in ether.
$C_{32} H_{31} K O_4$

Palmitate of Silver. Insoluble in warm water. (L. Smith, *Ann. Ch. et Phys.*, (3.) **6.** 47.)
$C_{32} H_{31} Ag O_4$

Palmitate of Soda. Soluble in water, and in dilute alcohol. Also soluble in absolute alcohol. More readily decomposed by water than the potash salt. (Maskelyne, *J. Ch. Soc.*, **8.** 8.) Soluble in water, in water containing carbonate of soda, and in absolute alcohol. (Lawrence Smith, *Ann. Ch. et Phys.*, (3.) **6.** 47.)
$C_{32} H_{31} Na O_4$

Palmitin. Soluble in hot, less soluble in cold ether. (Berthelot, *Ann. Ch. et Phys.*, (3.) **41.** 238.)
(*MonoPalmitate of Glyceryl.*)
$C_{38} H_{38} O_8 = C_6 H_5 O_3, 2 H O, C_{32} H_{31} O_3$

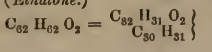
***Di*Palmitin.** Soluble in hot ether. (Berthelot, *loc. cit.*)
(*BiPalmitate of Glyceryl.*)
$C_{70} H_{68} O_{10} = C_6 H_5 O_3, H O, 2 C_{32} H_{31} O_3$

***Tri*Palmitin.** Insoluble in water. Almost insoluble in hot alcohol. Insoluble, or nearly so in cold ether. Easily soluble in boiling ether. Very slowly acted upon by an aqueous solution of caustic potash. (Maskelyne, *J. Ch. Soc.*, **8.** 7.) Very sparingly soluble in boiling alcohol. Soluble in all proportions in hot ether. (Boudet & Pelouze ?) Almost insoluble in cold, more soluble in boiling alcohol. Soluble in all proportions in boiling ether.
(*TerPalmitate of Glyceryl. Same as natural Palmitin.*)
$C_{102} H_{98} O_{12} = C_6 H_5 O_3, 3 C_{32} H_{31} O_3$

Sparingly soluble in cold, soluble in hot ether (Berthelot, *loc. cit.*)

Palmitonic Acid(?) (Schwarz.)
$C_{31} H_{31} O_4 = C_{31} H_{30} O_3, H O$

Palmitone. Soluble in strong boiling alcohol. Highly soluble in benzin. Unacted upon by dilute nitric acid, or by an aqueous solution of caustic potash. (Maskelyne, *J. Ch. Soc.*, **8.** 12.)
(*Ethalone.*)



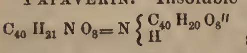
$C_{62}H_{62}O_2 = \left.\begin{matrix} C_{32}H_{31}O_2 \\ C_{30}H_{31} \end{matrix}\right\}$

Panacone. Insoluble in water, or ether. Soluble in alcohol. Soluble in concentrated sulphuric acid. (Garrigues, *Ann., Ch. u. Pharm.*, **90.** 234.)
$C_{22}H_{19}O_8$

Panaquilone(from the root of *Panax quinquefolius*). Easily soluble in water, and alcohol. Insoluble in ether. Soluble, with decomposition, in strong acids. (Garrigues, *Ann. Ch. u. Pharm.*, **90.** 232.)
$C_{24}H_{25}O_{18}$

Papaveric Acid(from *Papaver Rhœas*).
(*Rhœadic Acid.*)

Papaverin. Insoluble in water. Sparingly soluble in cold, more soluble in hot alcohol, and ether. (G. Merck.) Insoluble in an aqueous solution of caustic potash. More soluble than narcotin in boiling alcohol. Soluble in nitric acid, without decomposition, if this is not added in too great excess. (Anderson.) Most of its salts are difficultly soluble in water.



$C_{40}H_{21}NO_8 = N\left\{\begin{matrix} C_{40}H_{20}O_8'' \\ H \end{matrix}\right.$

Papyrin.
(*Vegetable Parchment.*)

Parabanic Acid. Permanent. More soluble than oxalic acid in water. Easily soluble in water. Soluble in boiling alcohol. Insoluble in iodide of ethyl.
$C_6H_2N_2O_6$

Parabanate of Ammonia. Known only in solution, and this gradually decomposes on standing. (Berzelius, *Lehrb.*, **3.** 323.)
$C_6(NH_4)_2N_2O_8$

Parabanate of Methyl. Soluble in 3 pts. of cold water; and in much less hot water. Readily soluble in alcohol, and ether. (Stenhouse.)
(*DiMethyl Parabanic Acid. Nitro Thein. Cholestrophan.*)
$C_6(C_2H_3)_2N_2O_6$

Parabanate of Silver. Insoluble in boiling water. Soluble in ammonia-water, and in nitric acid.
$C_6Ag_2N_2O_6$

Parabanate of Urea. Sparingly soluble in cold water. Soluble in boiling alcohol. (Hlaziwetz.)
$C_2H_4N_2O_2, C_6HN_2O_6$

ParaBenzin.
(*ParaBenzole.*)
$C_{12}H_6$

ParaBenzoic Acid. *Vid.* Benzoic Acid (Amorphous).

ParaCajputene. Insoluble in water, alcohol, or oil of turpentine. Soluble in ether. (Max. Schmidl.)
$C_{40}H_{32}$

ParaCamphoric Acid.
(*Racemic Camphoric Acid.*)
$C_{20}H_{16}O_8$

ParaCellulose. Insoluble in an aqueous solution of cupramin, but becomes soluble after being treated with acids or aqueous solutions of the alkalies, or after being boiled with water during 24 hours. Soluble in concentrated chlorhydric and sulphuric acids, and in boiling potash-lye. (Fremy.)

ParaCholic Acid. Insoluble in water. Its salts are identical with those of cholic acid in solubility, as in all other respects.
(*ParaGlycocholic Acid.*)
$C_{52}H_{43}NO_{12}$

ParaComenic Acid. Sparingly soluble in water. Less soluble than pyromeconic acid in water, and alcohol.
$C_{12}H_4O_{10}$

ParaCyanide of Silver.

ParaCyanogen. Insoluble in water. (Delbrueck.) Insoluble in alcohol. Soluble in hot concentrated chlorhydric, and sulphuric acids (Johnston); according to Berzelius, it is not dissolved, but is merely held in suspension by the sulphuric acid. Insoluble in nitric acid or in ammonia-water; but it dissolves in an aqueous solution of caustic potash, probably with decomposition. (Johnston.) Soluble in concentrated nitric, sulphuric, and chlorhydric acids, and is reprecipitated from the two last on the addition of water. Soluble in warm concentrated aqueous solutions of caustic and carbonated alkalies. (Johnston; Thaulow, in *Berzelius's Lehrb.*, **1.** 337.)
$C_{12}N_6$

ParaEllagic Acid. *Vid.* RufiGallic Acid.

"**Paraffin.**" Consists of several isomeric bodies, some of which are more soluble than others in alcohol. (Hofstædter, *Ann. Ch. u. Pharm.*, **91.** 330.) A specimen melting at 66.2° was insoluble in water, and was unacted upon by caustic potash, or by concentrated sulphuric or nitric acids. It dissolved in warm creosote, separating out again on cooling. It was difficultly soluble in cold alcohol. 100 pts. of boiling alcohol of 94% dissolved 3.5 pts. of it, the solution becoming solid on cooling. Warm ether dissolved about 130 to 140 pts. of it, the solution solidifying on cooling. It was easily soluble in warm oil of turpentine, and very easily in warm olive-oil, almond-oil, and castor-oil. A fossil substance, dug from a peat-bog, melting at 107.5°, exhibited the same solubility as the specimen above described, and resembled it in all respects, excepting the melting-point, and in containing less hydrogen. (Trommsdorff, *Ann. der Pharm.*, 1837, **21.** 128.) A specimen fusing at 58.25° and congealing at 54.50° dissolved in 3358.8 pts. of cold alcohol, of 0.833 sp. gr., and in 137.4 pts. of boiling alcohol, of 0.833 sp. gr.; in 78 pts. of cold, and in 9 pts. of boiling ether; in 33.5 pts. of cold oil of turpentine; and in 167.25 pts. of cold olive-oil. (E. Spiess.)

1 pt. of benzin dissolves 0.3 pt. of paraffin * at 20°
" " 0.7 " " 23°
" " 4.0 " " 39°
" " 5.0 " " 43°
" " 7.7 " " 46°

(Vogel & Scheller, *Dingler's Polytech. Journ.*, **164.** 221.)

1 pt. of chloroform dissolves 0.16 pt. of paraffin* at 17°, and 0.22 pt. at 23°. (Vogel & Scheller, *Dingler's Polytech. Journ.*, **164.** 221.)

1 pt. of bisulphide of carbon dissolves 1 pt. of paraffin* at 23°. (Vogel & Scheller, *Dingler's Polytech. Journ.*, **164.** 221.) Soluble in creosote, and eupion (coal-oil). (Reichenbach.) [Compare Melene.]

ParaGlobularetin. Soluble in alcohol, from which it is precipitated on the addition of water. Insoluble in ether. (Walz.)
$C_{24}H_{16}O_8$

ParaLactic Acid(of Heintz). *Vid.* SarcoLactic Acid.

ParaMaleic Acid. *Vid.* Fumaric Acid.

ParaMeconic Acid. *Vid.* Comenic Acid.

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* Obtained from oil distilled from lignite; the sample examined melted at 48°, and solidified at 45°.

ParaMenispermin. (*Isomeric with Menispermin.*) $C_{18}H_{11}NO_2$ Insoluble in water. Readily soluble in boiling alcohol. Sparingly soluble in ether. Soluble in dilute acids. (Pelletier & Courbe.)

ParaMidic Acid. *Vid.* Mellith*ter*amic Acid.

ParaMid. *Vid.* Mellithamid.

ParaMucic Acid. (*ParaSchleimsæure. Isomeric with Mucic and Saccharic Acids.*) $C_{12}H_{10}O_{16}$ Soluble in 73.6 pts. of cold, and in 17.2 pts. of boiling water; or 100 pts. of boiling water dissolve 5.8 pts. of it. (Malaguti.) More soluble than mucic acid in water. (Laugier.) Soluble in alcohol. (Malaguti.)

Its salts are more soluble than those of mucic acid, but are converted into the latter when their aqueous solutions are boiled.

ParaMucate of Ammonia. Is the only paramucate which is less soluble than the corresponding mucate. It is almost insoluble in boiling water.

ParaMucate of Silver.

ParaMylene. $C_{20}H_{20}$ Insoluble in water. (Kolbe's *Lehrb.*, **1.** 390.)

ParaMylone (from the infusorium *Euglena viridis*). $C_{24}H_{20}O_{20}$ Insoluble in water, dilute acids, ammonia-water, alcohol, ether, or saline solutions. Soluble, without decomposition, in strong potash-lye. (Gottlieb.)

ParaNaphthalin. (*Anthracene. Pyrene.*) $C_{30}H_{12}''(?)$ Insoluble in water. Scarcely at all soluble in alcohol, or ether. [Soluble in the oils of coal-tar.] Its best solvent is oil of turpentine.

ParaNicene. $C_{10}H_{12}(?)$ Insoluble in water. Soluble in alcohol, and ether. (St. Evre.)

ParaNicine. $C_{20}H_{13}N$ Insoluble in water. Soluble in alcohol, and ether. Also, with combination, in dilute nitric, acetic, chlorhydric, and oxalic acids. (St. Evre.)

ParaNitrAnilin. *Vid.* NitrAnilin(α).

ParaPectic Acid. $C_{24}H_{15}O_{21}, 2HO$ Soluble in water. The aqueous solution rapidly decomposes, with formation of metapectic acid. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** 37.) Alcohol precipitates it from the aqueous solution.

ParaPectate of Ammonia. Soluble in water.

ParaPectate of Baryta. Ppt.

ParaPectate of Lead. Ppt.
$C_{24}H_{15}O_{21}, 2PbO$

ParaPectate of Potash. Soluble in water. Insoluble in alcohol.

ParaPectate of Soda. Soluble in water.

ParaPectin. $C_{64}H_{40}O_{56}, 6HO$ Very soluble in water. Insoluble in alcohol. Decomposed by alkaline solutions, and by boiling acids. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** 14.)

ParaPectin with Lead. Ppt.
$C_{64}H_{40}O_{56}, 6HO, 2PbO$

ParaPicolin. $N\left\{C_{12}H_7'''\right.$ Soluble in all proportions in alcohol, ether, and the fatty and essential oils.

ParaPyroCitric Acid. *Vid.* Itaconic Acid

ParaSalicyl. *Vid.* BenzoSalicyl.

ParaTartralic Acid. $C_8H_4O_{10}$ Deliquescent. Soluble in water. In aqueous solution it changes to racemic acid; so also the solutions of its salts.

ParaTartralate of Baryta. Soluble in water.

ParaTartralate of Lead.

ParaTartralate of Potash. Soluble in water.

ParaTartralate of Soda. Soluble in water. (Fremy.)

ParaTartramid.
$C_8H_8N_2O_8 = N_2\left\{\begin{matrix}C_8H_4O_8''\\H_4\end{matrix}\right.$

ParaTartaric Acid. (*Racemic Acid. Uvic Acid. Vinic Acid. Traubensæure.*) $C_8H_6O_{12} + 2Aq = C_8H_4O_{10}, 2HO + 2Aq$ Permanent. Less soluble than tartaric acid in water, and alcohol. Soluble in 5.7 pts. of water, at 15°; and in 48 pts. of alcohol, of 0.809 sp. gr., at the ordinary temperature. (Walchner.) Soluble in 57.5 pts. of water at 15°; the saturated solution containing 17.39% of it. Less soluble in alcohol than in water. (Mohr, Redwood & Procter's *Pharmacy.*) Very sparingly soluble in a concentrated solution of tartaric acid.

Soluble in boiling creosote; the solution solidifies on cooling. (Reichenbach.)

ParaTartrate of Ammonia.

I.) *normal.* $C_8H_4(NH_4)_2O_{12}$ Very soluble in water. Scarcely at all soluble in alcohol. (Fresenius.)

II.) *acid.* $C_8H_5(NH_4)O_{12}$ Permanent. Soluble in 100 pts. of water at 20°; and much more soluble in boiling water. Insoluble in alcohol. (Fresenius.)

ParaTartrate of Ammonia & of Arsenious Acid. $C_8H_4(AsO_2)(NH_4)O_{12} + Aq$ Efflorescent. Soluble in 10.62 pts. of water at 15°; the solution undergoes decomposition when it is evaporated. (Werther.)

ParaTartrate of Ammonia & *of sesquioxide* of Iron. Easily soluble in water. (Walchner.)

ParaTartrate of Ammonia & of Soda. $C_8H_4Na(NH_4)O_{12} + 2Aq$ & $8Aq$ Efflorescent, Readily soluble in water, the solution undergoing decomposition when boiled. (Fresenius.) The aqueous solution saturated at 11° marks 23° Baumé, and at 21°, 28° Baumé. This salt consists of a mixture of the right and left tartrates of ammonia and of soda. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** pp. 58, 64.)

ParaTartrate of Antimony & of Potash.
$C_8H_4K(SbO_2)O_{12}$ &. $+ Aq$

ParaTartrate of Arsenious Acid & of Potash. $C_8H_4K(AsO_2)O_{12} + 3Aq$ Slowly efflorescent. Soluble in 7.96 pts. of water at 15°; the solution undergoing decomposition when evaporated. (Werther.)

ParaTartrate of Arsenious Acid & of Soda. $C_8H_4Na(AsO_2)O_{12} + 5Aq$ Soluble in 14.59 pts. of water at 19°. (Werther.)

ParaTartrate of Baryta. $C_8H_4Ba_2O_{12} + 5Aq$ Almost insoluble in cold water. Soluble in 200 [2000 ?] pts. of boiling water. Easily soluble in chlorhydric and nitric acids. (Fresenius.) Insoluble in acetic acid or in aqueous solutions of caustic potash, chloride of ammonium (hot), nitrate of ammonia, or succinate of ammonia. (Walchner.) Soluble in hot paratartaric acid, from which it is deposited on cooling.

ParaTartrate of Boracic Acid & of Potash. Hygroscopic. Readily soluble in water. (Fresenius.)

ParaTartrate of Boracic Acid & of Soda. Deliquescent. Soluble in water. (Fresenius.)

ParaTartrate of Cadmium. $C_8H_4Cd_2O_{12}$ Insoluble in water or in ordinary alcohol. (Schiff.)

ParaTartrate *of protoxide* **of Cerium.** Ppt. Readily soluble in paratartaric acid. (Beringer.)

ParaTartrate of Chromium. Soluble in water; from which solution it is precipitated on the addition of alcohol; after drying, this precipitate is not soluble in water, unless this be acidulated with paratartaric acid. (Fresenius.)

ParaTartrate of Cobalt. Sparingly soluble in cold or hot water; more readily soluble in paratartaric acid; and still more readily in chlorhydric acid, or an aqueous solution of caustic potash. (Fresenius.)

ParaTartrate of Cobalt & of Potash. Sparingly soluble in water. Easily soluble in paratartaric acid, and in an aqueous solution of caustic potash. (Fresenius.)

ParaTartrate *of dinoxide* **of Copper.** Tolerably soluble in water. (Walchner.)

ParaTartrate *of protoxide* **of Copper.** $C_8H_4Cu_2O_{12}+4\,Aq$ Permanent. Sparingly soluble in cold, more freely in hot water. Easily soluble in chlorhydric acid. (Fresenius.)

ParaTartrate *of protoxide* **of Copper & of Potash.** Sparingly soluble in boiling water. (Fresenius.)

ParaTartrate *of protoxide* **of Copper & of Soda.**

I.) *normal.* $C_8H_4NaCuO_{12}+Aq$ Very slowly soluble in cold, more readily soluble in hot water. (Werther.)

II.) *basic.* $C_8H_4NaCuO_{12};\ 2\,CuO+8\,Aq$ Sparingly soluble in cold, more readily soluble in hot water. Insoluble in alcohol. (Werther.)

ParaTartrate *of protoxide* **of Iron.** Sparingly soluble in water. Readily soluble in paratartaric, acetic, and the mineral acids, in ammonia-water, and an aqueous solution of caustic potash.

ParaTartrate *of sesquioxide* **of Iron.** Very soluble in water, from which it is precipitated by alcohol, but not by alkaline solutions. (Fresenius.)

ParaTartrate *of sesquioxide* **of Iron & of Potash.** Deliquescent. Soluble in water, and in paratartaric acid. It is not precipitated by alkaline solutions.

ParaTartrate of Lead. $C_8H_4Pb_2O_{12}$ Soluble in warm paratartaric acid. More soluble in tartaric acid than tartrate of lead.

ParaTartrate of Lime. $C_8H_4Ca_2O_{12}+8\,Aq$ Sparingly soluble in boiling, almost insoluble in cold water. Less soluble than sulphate of lime in water. Scarcely at all soluble in an aqueous solution of chloride of ammonium. (H. Rose.) Sparingly soluble in warm solutions of sulphate, and succinate, of ammonia and chloride of ammonium. (Wittstein.) Readily soluble in a cold solution of caustic potash, from which it is reprecipitated on the addition of water. Soluble in chlorhydric acid, from which it is precipitated by ammonia. Insoluble in acetic acid, or in paratartaric acid, after it has once become crystallized.

ParaTartrate of Magnesia. $C_8H_4Mg_2O_{12}+10\,Aq$ Effloresces in dry air. Soluble in 120 pts. of water at 19°; and in less boiling water. Insoluble in alcohol. Soluble, without change, in paratartaric acid. Easily soluble in strong mineral acids. Insoluble in acetic acid. Soluble in potash-lye. (Fresenius.)

ParaTartrate of Manganese. $C_8H_4Mn_2O_{12}+2\,Aq$ Permanent. Very sparingly soluble in cold, more readily soluble in hot water. Readily soluble in acids, and also in alkaline solutions; hence neither acids nor alkalies precipitate it one from the other. (Fresenius.)

ParaTartrate *of dinoxide* **of Mercury.** Insoluble in water or in paratartaric acid. Easily soluble in nitric acid. (Fresenius.)

ParaTartrate of Methyl. *Vid.* Methyl-ParaTartaric Acid.

ParaTartrate of Nickel. $C_8H_4Ni_2O_{12}+10\,Aq$ Effloresces slowly in dry air. Sparingly soluble in hot water, more soluble in paratartaric acid, and still more soluble in chlorhydric acid. Soluble, also, in aqueous solutions of caustic potash, and of warm carbonate of soda. (Werther.)

ParaTartrate of Potash.

I.) *normal.* $C_8H_4K_2O_{12}+4\,Aq$ Permanent. Soluble in 0.97 pt. of water at 25°. Almost insoluble in alcohol. (Fresenius.)

II.) *acid.* $C_8H_5KO_{12}$ Permanent. Soluble in 180 pts. of water at 19°; in 139 pts. of water at 25°, and in 14.3 pts. of boiling water. Less soluble in water than the corresponding tartrate. Insoluble in alcohol. Easily soluble in the mineral acids. (Fresenius.)

ParaTartrate of Potash & of Soda. $C_8H_4KNaO_{12}+8\,Aq$ Efflorescent. Easily soluble in water. (Fresenius.) Consists of a mixture of the right and left tartrates of potash and soda. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** 63.) Soluble in 1.32 pts. of water at 6°, and in all proportions in hot water.

ParaTartrate of Silver. $C_8H_4Ag_2O_{12}$ Sparingly soluble in water, being less soluble than the tartrate of silver. Soluble in ammonia-water. (Liebig & Redtenbacher.)

ParaTartrate of Soda.

I.) *normal.* $C_8H_4Na_2O_{12}$ Permanent. Soluble in 2.63 pts. of water at 25°. Insoluble in alcohol. (Walchner.)

II.) *acid.* $C_8H_5NaO_{12}+2\,Aq$ Permanent. Soluble in 11.3 pts. of water at 19°; and in much less boiling water. Insoluble in alcohol. (Fresenius.)

ParaTartrate of Strontia. $C_8H_4Sr_2O_{12}+8\,Aq$ Almost insoluble in cold, very sparingly soluble in boiling water. Easily soluble in chlorhydric acid. Insoluble in acetic acid. (Fresenius.) It forms clear solutions with hot aqueous solutions of nitrate and succinate of ammonia and chloride of ammonium; but these solutions become turbid on cooling. (Wittstein.)

ParaTartrate of StibEthylium. Very deliquescent. Soluble in water.

ParaTartrate of Tin. Soluble in water. (Walchner.)

ParaTartrate of Zinc. Scarcely at all soluble in water; more soluble in paratartaric acid, and still more soluble in chlorhydric acid. (Werther.)

ParaTartrelic Acid.
$C_8 H_4 O_{10}$

ParaTartrate of Baryta.

ParaTartrate of Lime.

ParaTartroMethylic Acid. *Vid.* MethylParaTartaric Acid.

ParaTartroVinic Acid. *Vid.* EthylParaTartaric Acid.

ParaThionic Acid. Not isolated.
(Beta Sulpho Vinic Acid.)

ParaThionate of Baryta. Soluble in water, the solution not undergoing decomposition when boiled.
$C_4 H_5 Ba S_2 O_8 + 2 Aq$

ParaThionate of Lime.
$C_4 H_5 Ca S_2 O_8 + 2 Aq$

Parellic Acid. Very sparingly soluble in cold water. Easily soluble in alcohol, and ether, from which water precipitates it. More soluble in acetic acid than in water. Slowly soluble in aqueous solutions of caustic potash, lime, and baryta, from which it is precipitated by acids; less soluble in ammonia-water.
(Parellin.)
$C_{18} H_6 O_8 = C_{18} H_5 O_7, H O$ & $+ Aq$

Parellate of Baryta. Insoluble in water. Soluble in warm baryta-water.

Parellate of Copper. Ppt.

Parellate of Lead.
$C_{18} H_5 Pb O_8(?)$

Paricin. Sparingly soluble in water. Easily soluble in alcohol, and ether. Soluble in dilute acids, forming salts which are readily soluble. (Winkler.)

Paridin (from *Paris quadrifolia*). 100 pts. of water dissolve 1.5 pts. of it; 100 pts. of alcohol of 94.5% dissolve 2 pts. of it, and 100 pts. of ordinary alcohol, 6 pts. of it. Insoluble in ether. Soluble in chlorhydric acid. Decomposed by sulphuric, phosphoric, and nitric acids; also by a warm solution of caustic potash.
$C_{12} H_{10} O_6$? or $C_{16} H_{14} O_7 + 2 Aq(?)$

Parietic Acid. *Vid* Chrysophanic Acid.

Parietin. *Vid.* Usnic Acid.

Pariglin. *Vid.* Smilacin.

Parvolin. Soluble in coal-oil naphtha. (Gr. Williams.)
(Isomeric with Cumidin.)
$N \left\{ C_{18} H_{13}''' \right.$

Pearlash. *Vid.* Carbonate of Potash.

Pectase. Exists in vegetables in two states, — in one of which it is soluble, while in the other it is insoluble in water. The aqueous solution of the soluble modification soon undergoes decomposition when left to itself. The soluble form is converted into the insoluble by adding alcohol to the aqueous solution, the precipitate which forms being no longer soluble in water. Both modifications are insoluble in alcohol. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** 21.)

Pectic Acid. Insoluble in cold, scarcely at all soluble in boiling water. After standing for a long time with water it dissolves completely, with decomposition. It is also dissolved, with decomposition, by long-continued boiling with water. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** pp. 26, 36.) Soluble in water. (Schunck.) Slightly soluble in boiling water. The aqueous solution is coagulated by alcohol, and by a solution of sugar. Easily soluble in alkalies, from which it is precipitated by alcohol as well as by acids. (John Porter, *Am. J. Sci.*, (2.) **9.** 21.) Easily soluble in alkaline liquids, even when these are very dilute; it is quickly decomposed, however, by an excess of alkali. (Fremy, *loc. cit.*, p. 28.) When boiled with dilute acids it is converted into metapectic acid, which dissolves. (Fremy.) Insoluble in alcohol, ether, or the organic acids. (Braconnot.)
$C_{32} H_{20} O_{28}, 2 H O$

The aqueous solutions of many neutral salts, of almost all the organic salts of ammonia, and especially the soluble pectates, dissolve considerable quantities of pectic acid, forming with it ill-defined compounds which are soluble in water and precipitable therefrom by alcohol. (Fremy, *loc. cit.*, pp. 28, 32.)

The alkaline pectates are soluble in water, but insoluble in alcohol. The other pectates are insoluble. Insoluble pectic acid is precipitated when they are treated with acids.

Pectate of Ammonia. Soluble in water, from which solution it is precipitated by alcohol.

Pectate of Baryta. Ppt.

Pectate of Copper. Insoluble in boiling water. (Braconnot.)

Pectate of Lead. Ppt., decomposed by boiling water.
$C_{32} H_{20} O_{28}, 2 Pb O$

Pectate of Lime. Insoluble in boiling water, and ammonia-water.

Pectate of Potash. Soluble in water, less soluble in a solution of potash.

Pectate of Silver, Ppt.

Pectate of Soda. Soluble in water.

Pectin. Soluble in cold water, from which it is precipitated by alcohol. On boiling the aqueous solution it is transformed to parapectin. Decomposed by alkaline solutions, also by boiling dilute acids. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** pp. 12, 14, 36.) When its aqueous solution is allowed to stand, pectin changes into metapectic acid, the transformation being more rapid in case pectose is likewise present.
$C_{64} H_{40} O_{56}, 8 H O$

PectoLactic Acid. Deliquescent. Soluble in all proportions in water, and alcohol. Insoluble in ether. The pectolactates of the alkalies and alkaline earths are all easily soluble in water, excepting the lime salt; they are all insoluble in alcohol. (Bœdeker & Struckmann, *Ann. Ch. u. Pharm.*, **100.** 284.)
$C_{16} H_8 O_{12} = C_{16} H_8 O_{10}, 2 H O + 2 Aq$ & $5 Aq$

PectoLactate of Baryta. Easily soluble in water. Insoluble in alcohol. (B. & S.)
$C_{16} H_6 Ba_2 O_{12} + 6 Aq$ & $9 Aq$

PectoLactate of Cobalt. Insoluble in water. Easily soluble in an excess of pectolactic acid. (B. & S.)

PectoLactate of Copper. Insoluble in water. Easily soluble in an excess of pectolactic acid. Soluble in a solution of caustic soda. (B. & S.)

PectoLactate *of sesquioxide* **of Iron.** Insoluble in water, or pec-
$6 Fe_2 O_3, C_{16} H_6 O_{10} + 8 Aq$

tolactic acid. Soluble in a solution of caustic soda. (B. & S.)

PectoLactate of Lead.

I.) Insoluble in water. Soluble in pectolactic acid and in an aqueous solution of acetate of lead. (B. & S.)

II.) *basic.* Insoluble in water, or an aqueous solution of acetate of lead. Soluble in pectolactic acid. (B. & S.)

PectoLactate of Mercury.

I.) *of the dinoxide.*
II.) *of the protoxide.* } Insoluble in pectolactic acid. Difficultly soluble in dilute nitric acid. (B. & S.)

PectoLactate of Zinc. Insoluble in water. Easily soluble in pectolactic acid. (B. & S.)

Pectose. Insoluble in water, alcohol, or ether. By the action of warm acids, excepting acetic acid, it is converted into pectin. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** 7.)

Pectosic Acid. $C_{32}H_{20}O_{28}, 3HO$ Scarcely at all soluble in cold water, but is easily soluble in boiling water, the solution gelatinizing on cooling. Insoluble in water acidulated with chlorhydric acid, or other acids. Gradually decomposed by the action of boiling water, or alkaline liquors. (Fremy, *Ann. Ch. et Phys.*, (3.) **24.** 23.)

Pectosate of Baryta. $C_{32}H_{20}O_{28}, HO, 2BaO$ Ppt., soluble in dilute acids.

Pectosate of Lead. $C_{32}H_{20}O_{28}, HO, 2PbO$ Ppt., soluble in warm dilute acids.

Pelargonic Acid(Anhydrous). (*Pelargonic Pelargonate.*) $C_{36}H_{34}O_6 = \left.\begin{matrix}C_{18}H_{17}O_3\\C_{18}H_{17}O_3\end{matrix}\right\}$ Very slowly acidified by water. (Chiozza, *Ann. Ch. et Phys.*, (3.) **39.** 208.)

Pelargonic Acid. (*Identical with Œnanthic Acid*, according to Dellfs.) $C_{18}H_{18}O_4 = C_{18}H_{17}O_3, HO$ Scarcely at all soluble in water. (Gerhardt.) Very difficulty soluble in water. Readily soluble in alcohol, and ether. (Redtenbacher.)

Pelargonate of Ammonia. With water it forms a soapy solution. Very readily soluble in cold alcohol. (Gerhardt.)

Pelargonate of Baryta. $C_{18}H_{17}BaO_4$ Permanent. Slightly soluble in water. Soluble in boiling, less soluble in cold alcohol. (Cahours, *J. Ch. Soc.*, **3.** 241.) Difficultly soluble in water, and alcohol. (Redtenbacher.) Much less soluble in water or alcohol than the valerate, œnanthylate, or caprylate of baryta, but more soluble than the rutylate.

Pelargonate of Benzoyl. *Vid.* Benzo-Pelargonic Acid.

Pelargonate of Copper. $C_{18}H_{17}CuO_4 + 2Aq$ Soluble in boiling alcohol.

Pelargonate of Ethyl. $C_{18}H_{17}(C_4H_5)O_4$ Insoluble in water. Soluble in alcohol.

Pelargonate of Lime. $C_{18}H_{17}CaO_4$ Difficultly soluble in water. Soluble in boiling, less soluble in cold alcohol. (Cahours.)

Pelargonate of Phenyl. $C_{18}H_{17}(C_{12}H_5)O_4$

Pelargonate of Potash. Readily soluble in water. (Cahours.)

Pelargonate of Silver. $C_{18}H_{17}AgO_4$ Very sparingly soluble in water, even when this is boiling.

Pelargonate of Soda. Readily soluble in water. Soluble in alcohol.

Pelargonate of Strontia. Slightly soluble in water. Soluble in boiling, less soluble in cold alcohol. (Cahours, *J. Ch. Soc.*, **3.** 241.)

Pelargonic Acid with *bin***Oxide of Nitrogen**(NO_2). *Vid.* NitrosoPelargonic Acid.

Pelárgone. *Vid* Oxide of Capryl & of Pelargoyl.

Pelargonene. *Vid.* Nonylene.

Pellutein. $N\left\{C_{36}H_{19}O_6''\right.$ Soluble in hot, less soluble in cold alcohol. Insoluble in ether.

Pelosin. (*Cissampelin. Isomeric with Codein.*) $N\left\{C_{36}H_{21}O_6'''\right.$ Sparingly soluble in water. Easily soluble in alcohol; and ether. When the ethereal solution is mixed with water a hydrate, containing 3 equivs. of H O is formed, which is insoluble in water, alcohol, or ether.

The salts of pelosin are generally readily soluble in water. (Wiggers.)

Penta. See *penta*, as prefix, under the generic name of the substance sought for.

Pepsin. Soluble in water, from which it is precipitated on the addition of alcohol.

PerChloric Acid. ClO_7, HO Deliquescent. Very soluble in water. The most concentrated aqueous solution is of 1.65 sp. gr. and boils at 200°. (Serullas, *Ann. Ch. et Phys.*, (2.) **46.** 296.)

All of its salts are soluble in water, — the potash salt somewhat difficultly; they are all deliquescent, and soluble in alcohol, excepting those of ammonia, potash, lead, and dinoxide of mercury. (Sérullas, *loc. cit.*, p. 308.)

PerChlorate of Alumina. $Al_2O_3, 3ClO_7$ Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, 1831, (2.) **46.** 304.)

PerChlorate of Ammonia. NH_4O, ClO_7 Permanent. Soluble in 5 pts. of water, and slightly in alcohol. The aqueous solution loses ammonia when evaporated. The normal salt is precipitated when strong perchloric acid is added to its concentrated aqueous solution. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 304.)

PerChlorate of Baryta. BaO, ClO_7 Deliquescent. Very soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 303.)

PerChlorate of Brucin. Sparingly soluble in cold water, more soluble in warm water and in alcohol.

PerChlorate of Cadmium. CdO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 305.)

PerChlorate of Cinchonin. $C_{40}H_{24}N_2O_2, 2(ClO_7, HO) + 2Aq$ Permanent. Readily soluble in water, and alcohol. (Bœdecker.)

PerChlorate of Codein. Readily soluble in water, and alcohol. (Bœdecker.)

PerChlorate *of protoxide* **of Copper.** CuO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 305.)

PerChlorate of Ethyl. C_4H_5O, ClO_7 Insoluble in water. Soluble in alcohol, but this solution eventually undergoes a partial decomposition. (Hare & Boyé.)

PerChlorate of Furfurin. Readily soluble in water, and alcohol. (Bœdeker.)
$C_{30}H_{13}N_2ClO_{14} + 2Aq =$
$N_2 \} (C_{10}H_4O_2'')_3, HO, ClO_7 + 2Aq$

PerChlorate *of protoxide* of Iron. FeO, ClO_7 Tolerably permanent. Soluble in water. (Sérullas, p. 305.)

PerChlorate *of sesquioxide* of Iron. $Fe_2O_3, 3ClO_7$ Soluble in water. (Berzelius, *Lehrb.*)

PerChlorate of Lead. PbO, ClO_7 Permanent. Soluble in about 1 pt. of water. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 306.)

PerChlorate of Lime. CaO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 304.)

PerChlorate of Lithia. LiO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 304.) A solution of perchloric acid produces a slight precipitate in very concentrated solutions of lithia salts, but this precipitate readily dissolves on adding water. (H. Rose, *Tr.*)

PerChlorate of Magnesia. MgO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 304.)

PerChlorate of Manganese. MnO, ClO_7 Very deliquescent. Soluble in water, and in the strongest alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 305.)

PerChlorate *of dinoxide* of Mercury. Hg_2O, ClO_7 Permanent. Soluble in water. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 306.)

PerChlorate *of protoxide* of Mercury. HgO, ClO_7 Exceedingly deliquescent. Soluble in water. Partially soluble, with decomposition, in alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 306.)

PerChlorate of Morphine. $C_{34}H_{19}NO_6, HO, ClO_7 + 4Aq$ Tolerably soluble in water, and alcohol.

PerChlorate of Potash. $KO, ClO_7.$ Permanent. Is the least soluble of any of the metallic perchlorates.

Soluble in 65 pts. of water at 15°; more soluble in hot water. Insoluble in alcohol. (Sérullas, *Ann. Ch. et Phys.*, 1831, (2.) **46.** pp. 297 – 301, 302.) Soluble in 88 pts. of water at 10°, and in 5.52 pts. of water at 100°. (Hutstein, *Arch. Pharm.*, (2.) **65.** 159; in *Liebig & Kopp's Jahresbericht*, **4.** 331.) Soluble in 60 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76.) Soluble in 4.5 pts. of boiling water.

Insoluble in spirit of 38°. (Millon, *Ann. Ch. et Phys.*, (3.) **7.** 332.)

PerChlorate of Potash with PerManganate of Potash. The two salts crystallize together in all proportions. The compounds formed are soluble in water. (Wœhler.)

PerChlorate of Quinine. $C_{40}H_{24}N_2O_4, 2(ClO_7, HO) + 14Aq$ Slowly soluble in water. Readily soluble in alcohol.

PerChlorate of Silver. AgO, ClO_7 Deliquescent. Very soluble in water. Soluble in concentrated alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** pp. 307, 299.)

PerChlorate of Soda. NaO, ClO_7 Very deliquescent. Very soluble in water, and in the strongest alcohol. (Sérullas, *Ann. Ch. et Phys.*, 1831, (2.) **46.** pp. 297 – 301, 303.)

PerChlorate of Strontia. SrO, ClO_7 Very deliquescent, and soluble in water. Readily soluble in alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 303.)

PerChlorate of Strychnine. $C_{42}H_{22}N_2O_4, HO, ClO_7 + 2Aq$ Sparingly soluble in cold water; much more soluble in alcohol. (Bœdeker.)

PerChlorate *of protoxide* of Uranium. UrO, ClO_7 Soluble in water.

PerChlorate of Zinc. ZnO, ClO_7 Deliquescent. Soluble in water, and alcohol. (Sérullas, *Ann. Ch. et Phys.*, (2.) **46.** 305.)

PerChromic Acid. Cr_2O_7 Soluble in water, and ether. Both solutions soon undergo decomposition, but the ethereal solution is much more stable than the aqueous. (Barreswil, *Ann. Ch. et Phys.*, (3.) **20.** 367.)

PerChromic Acid with Quinine.
" " **Strychnine.** } Insoluble in ether. (Barreswil.)

Pereirin (from *Pao Pereiro*). Only slightly soluble in water. Very easily soluble in alcohol, and ether. Also soluble in concentrated sulphuric and nitric acids. Most of its salts are soluble in water, and alcohol. (Goos.)

PerIodic Acid. (*HyperIodic Acid. OxIodic Acid.*) $IO_7, 5HO$ Deliquescent. Readily soluble in water. Tolerably soluble in alcohol, and ether. (Benckiser.) Sparingly soluble in concentrated alcohol, and less soluble in ether. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 258.) Most of the salts of periodic acid are difficultly soluble or insoluble in water; all of them are insoluble, or very sparingly soluble in alcohol; but they all dissolve with tolerable facility in dilute nitric acid. (Benckiser.)

PerIodate of Ammonia. $NH_4O, IO_7 + 4Aq$ Easily soluble in water slightly acidulated with nitric acid. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 265.)

PerIodate of Baryta.

I.) $5BaO, IO_7$ Insoluble in water. Soluble in nitric acid. (Rammelsberg.)

II.) $5BaO, 2IO_7 + 5Aq$ Insoluble in water. Easily soluble in weak nitric acid. (Benckiser.)

III.) $2BaO, IO_7 + 3Aq$

PerIodate of Brucin. Tolerably soluble in water, and alcohol. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 278.)

PerIodate of Cinchonin. Alterable. Soluble in alcohol. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 277.)

PerIodate of Copper. $4CuO, HO, IO_7$ Insoluble in water. Soluble in dilute nitric acid. (Benckiser.)

PerIodate of Lead.

I.) $3PbO, 2HO, IO_7$ Easily soluble in water slightly acidulated with nitric acid. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 270.)

II.) *basic.* Insoluble in water, or an aqueous solution of periodic acid. Readily soluble in dilute nitric acid. (Benckiser, *Ann. Ch. u. Pharm.*, **17.** 254.)

PerIodate of Lime.

I.) $2CaO, 3HO, IO_7$

II.) $5\,CaO, IO_7$ Insoluble in water. Soluble in nitric acid. (Berzelius's *Lehrb.*, **3.** 413.)

PerIodate of Lithia. Soluble in water. Decomposed by spirit. (Rammelsberg.)

PerIodate of Magnesia. $2\,MgO, 3\,HO, IO_7 + 9\,Aq$ Insoluble in water. Soluble in periodic acid. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 268.)

PerIodate of Mercury.
I.) *of the dinoxide*(Hg_2O). } Easily soluble in
II.) *of the protoxide*(HgO). } dilute nitric acid.
(Benckiser.)

PerIodate of Potash.
I.) *normal.* Very sparingly soluble in water.
KO, IO_7
II.) *basic.* Very sparingly soluble in water.
$2\,KO, IO_7$

PerIodate of Quinine. $C_{40}H_{24}N_2O_4, HO, IO_7 + 22\,Aq$ Sparingly soluble in water. Easily soluble in water acidulated with nitric acid. Soluble in alcohol. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 276.)

PerIodate of Silver.
I.) AgO, IO_7 Insoluble in water. By the action of hot water it is transformed into No. II. (Ammermuller & Magnus.)

II.) $2\,AgO, HO, IO_7$ Insoluble in hot water. Soluble in warm nitric acid. (A. & M.)

III.) $2\,AgO, 3\,HO, IO_7$ By the action of hot water it is decomposed to No. II. (A. & M.)

PerIodate of Soda.
I.) NaO, IO_7 Readily soluble in water. (Magnus.) Permanent. Soluble, without decomposition, in dilute nitric acid. (Benckiser.)

II.) $2\,NaO, 3\,HO, IO_7$ Insoluble in cold, sparingly soluble in hot water. (Magnus.)

PerIodate of Strontia. $2\,SrO, 3\,HO, IO_7$ Resembles the baryta salt.

PerIodate of Strychnine. Tolerably soluble in water, and alcohol. (Langlois, *Ann. Ch., et Phys.*, (3.) **34.** 278.)

PerIodate *of protoxide* of Uranium. Ppt., which soon becomes oxidized.

PerIodate *of sesquioxide* of Uranium. Somewhat soluble in hot water, and in an aqueous solution of protochloride of uranium. (Rammelsberg.)

PerIodate of Veratrin. Soluble in alcohol. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 278.)

PerIodate of Zinc.
I.) $4\,ZnO, HO, IO_7$ Easily soluble in water slightly acidulated with nitric acid. (Langlois, *Ann. Ch. et Phys.*, (3.) **34.** 269.)

II.) $3\,ZnO, 7\,HO, 2\,IO_7$

" *Basic*PerIodite of Lead(?)." (See Gmelin's *Handbook*, **5.** 143.)

I.) *Blue salt.* Insoluble in water, or in aqueous solutions of acetate of lead, or sugar. Decomposed by the weakest acids. (Durand.)

II.) *Violet salt.* Slowly decomposed by water. Not decomposed by alcohol. Soluble in an aqueous solution of caustic potash. (Jammes.)

PerManganic Acid. Mn_2O_7 Known only in aqueous solution, which is decomposed on evaporating.

Its salts are all soluble in water, excepting the silver salt, which is difficultly soluble.

PerManganate of Ammonia. NH_4O, Mn_2O_7 Soluble in water. (Mitscherlich.)

PerManganate of Baryta. BaO, Mn_2O_7 Permanent. Soluble in water.

PerManganate of Copper(CuO). CuO, Mn_2O_7 Deliquescent. (Mitscherlich.)

PerManganate of Lead. PbO, Mn_2O_7 Soluble in nitric acid. (Forchammer.)

PerManganate of Lime. Deliquescent. (Mitscherlich.)

PerManganate of Lithia. LiO, Mn_2O_7 Permanent. Soluble in water.

PerManganate of Magnesia. MgO, Mn_2O_7 Deliquescent. Soluble in water.

PerManganate of Potash. KO, Mn_2O_7 Soluble in 16 pts. of water at 15°. Immediately decomposed by alcohol. (Mitscherlich.) The aqueous solution saturated at 15° contains 0.06% of its weight of the salt. (Berzelius's *Lehrb.*)

PerManganate of Silver. AgO, Mn_2O_7 Soluble in 109 [190 ?] pts. of cold water, and in much less hot water. (Mitscherlich.)

PerManganate of Soda. NaO, Mn_2O_7 Deliquescent. Very soluble in water. (Mitscherlich.)

PerManganate of Strontia. Deliquescent. Soluble in water. (Mitscherlich.)

PerManganate of Zinc. ZnO, Mn_2O_7 Deliquescent. Soluble in water. (Mitscherlich.)

PerSpiroylic Acid. *Vid.* Salicylic Acid.

PerSulphate(&c.) of *X*. See under Sulphate of *X*, as *per*Sulphate of *X*, and the like.

*PerSulfure EthylSulfocarbonique. Vid. bi*Carbonate of *bi*Sulphide of Ethyl.

PerSulphoCyanogen. *Vid. per*SulphoCyanogen.

PerSulphoMolybdate of *X*. *Vid. per*SulphoMolybdate of *X*.

Peruric Acid. $C_{10}H_5N_4O_9(?)$ Slowly soluble in water. Soluble in ammonia-water. Easily and abundantly soluble in aqueous solutions of the caustic and carbonated alkalies. (Unger.) Difficultly soluble in acids.

Perurate of Silver. Insoluble in water.
$C_{10}H_3Ag_2N_4O_9(?)$

Peruvin. *Vid.* Styrone.

Petasite(from the root of *Tussilago Petasites*).

Petinin. $C_8\ H_{11}\ N = N\left\{\begin{matrix} C_8\,H_9 \\ H_2 \end{matrix}\right.$ *(Isomeric with Butylamin, Biethylamin, Bimethylethylamin, and Methylpropylamin.)* Soluble in all proportions in water, alcohol, ether, and oils. Its salts are soluble in water, and alcohol. Readily soluble in dilute, but insoluble in a strong, aqueous solution of caustic potash. It combines with the stronger acids, forming salts which are permanent, and are all soluble in water. (Anderson.)

Petrolene. *(Isomeric with Tekoretin.)* $C_{40}H_{32}''$ Sparingly soluble in alcohol. Easily soluble in ether. (Boussingault.)

Petroleum. Soluble in 18 pts. of alcohol, of 0.85 sp. gr. (Parrish's *Pharm.*, p. 346.)
(*Oleum petræ.*)

Peucedanin. Insoluble in water. Very sparingly soluble in cold, readily soluble in boiling alcohol. Readily soluble in ether and in the fatty and volatile oils. Insoluble in dilute acids. Soluble in concentrated sulphuric acid, from which it is precipitated, unchanged, by water. (Wackenroder.) Soluble, with decomposition, in warm nitric acid. Also soluble in an aqueous solution of caustic potash; but only sparingly soluble in ammonia-water, or in chlorhydric or acetic acids.
(*Imperatorin. Angelate of Oreoselone.*)
$C_{24}H_{12}O_6 = \left.\begin{matrix} C_{14}H_5O_2 \\ C_{10}H_7O_2 \end{matrix}\right\} O_2$

Peucyl (of Blanchet & Sell). *Vid.* Terebilene.

Phæoretin. Exceedingly difficultly soluble in water, and ether. Easily soluble in alcohol, and in aqueous alkaline solutions. Soluble in acetic acid and in concentrated sulphuric acid. (Schlossberger & Dœpping.)
$C_{16}H_8O_7$

***Di*Phanin.** *Vid. di*Phenin.

Phaseomannite. Identical with Inosite, *q. v.*

PhenAmyl. *Vid.* Phenate of Amyl.

PhenAmylol. *Vid.* Phenate of Amyl.

***Bi*PhenAnilin.** *Vid. tri*Phenylamin.

Phenic Acid (Anhydrous). Insoluble in water. Scarcely at all soluble in alcohol. Easily soluble in ether.
(*Phenate of Phenyl. Phenyl Ether. Phenic Anhydride.*)
$C_{24}H_{10}O_2 = \left.\begin{matrix} C_{12}H_5O \\ C_{12}H_5O \end{matrix}\right\}$

Phenic Acid. Sparingly soluble in water. Soluble in all proportions in alcohol, ether, and acetic ether. Readily soluble in concentrated acetic acid. (Reichenbach; Runge; Laurent.) Soluble in 80 pts. of water at 20°, and in 22 pts. of water at 100° (Reichenbach); in 31 pts. of water at 20° (Runge). No more soluble in chlorhydric acid than in water; but much more soluble in dilute acetic acid than in water. (Laurent.) Soluble in 17 pts. of a cold mixture of equal parts of glacial acetic acid and water, and in 10 pts. of the same mixture when warm. Soluble in 30 pts. of hot, less soluble in cold phosphoric acid of 1.135 sp. gr. (Reichenbach.) Soluble in all proportions in bisulphide of carbon, and the volatile oils. (Reichenbach.)
(*Carbolic Acid. Phenol. Hydrate of Phenyl. Hydrated Oxide of Phenyl. Phenous Acid. Spirol. Phenylic Acid. Salicon. Phenyl Alcohol. Often confounded with Creosote.*)
$C_{12}H_6O_2 = C_{12}H_5O, HO$

Phenate of Ammonia. Soluble in water, and alcohol. (Laurent.)
$C_{12}H_5(NH_4)O_2(?)$

Phenate of Amyl. Insoluble in water. Easily soluble in alcohol, and ether. Soluble, with combination, in concentrated sulphuric acid.
(*PhenAmylol. PhenAmyl. AmylPhenic Ether.*)
$C_{12}H_5(C_{10}H_{11})O_2$

Phenate of Baryta. Soluble in water. (Laurent.)
$C_{12}H_5BaO_2 + 3\,Aq$

Phenate of BromEthyl, &c. *Vid.* BromoPhenate of Ethyl, &c.

Phenate of Ethyl. Insoluble in water. Easily soluble in alcohol, and ether. Unacted upon by an aqueous solution of caustic potash. Soluble in concentrated sulphuric acid, with combination: the baryta-salt of this conjugate acid is soluble in water. (Cahours, *Ann. Ch. et Phys.*, (3.) **27.** 464.)
(*Phenetol. Salithol. EthylPhenic Ether.*)
$C_{12}H_5(C_4H_5)O_2$

Phenate of Ethyl*nitré*. *Vid.* NitroPhenate of Ethyl.

Phenate of Ethyl*trinitré*. *Vid.* Picrate of Ethyl.

Phenate of Lead.

I.) *normal?* Soluble in alcohol, from which it is partially precipitated on the addition of water.

II.) *basic.* Ppt. Soluble in anhydrous phenic acid. (Runge.)
$2(C_{12}H_5PbO_2); PbO, HO$

Phenate of Lime. Soluble in water, from which it is precipitated on adding much alcohol. (Runge.)

Phenate of Methyl. Insoluble in water. Soluble in alcohol, and ether. Insoluble in an aqueous solution of caustic potash. Soluble, with combination, in fuming sulphuric acid. (Cahours, *Ann. Ch. et Phys.*, (3.) **10.** 353.)
(*Anisol. Dracol. MethylPhenic Ether.*)
$C_{12}H_5(C_2H_3)O_2$

Phenate of Methyl*bromé*; Methyl*chloré*, Methyl*nitré*, &c. *Vid.* BromoPhenate, ChloroPhenate, NitroPhenate (&c.) of Methyl.

Phenate of Phenyl. *Vid.* Phenic Acid (Anhydrous).

Phenate of Potash. Deliquescent. Very soluble in water, alcohol, and ether. (Laurent.)
$C_{12}H_5KO_2(?)$

Phenate of Soda. Very readily soluble in water and in phenic acid. Insoluble in soda lye. (Reichenbach.)

Phene. *Vid.* Hydride of Phenyl.

***Bi*PhenEthAnilin.** *Vid.* Hydrate of Ethyl*tri*Phenylammonium.

Phenetidine nitrique. *Vid.* EthylNitroPhenidin.

Phenetol. *Vid.* Phenate of Ethyl.

Phenic Alcohol. *Vid.* Phenic Acid.

Phenidamin. *Vid.* AzoPhenylamin.

Phenidin. *Vid.* Benzoate of Phenyl.

***Di*Phenin.** Soluble in ether, and in chlorhydric, and nitric acids. (Laurent & Gerhardt.)
$C_{12}H_6N_2 = N_2\left\{\begin{matrix} C_{12}H_2'' \\ H_4 \end{matrix}\right.$

Phenol. *Vid.* Phenic Acid.

Phenic Amid. *Vid.* Anilin.

Phenous Acid. *Vid.* Phenic Acid.

PhenoylBenzoicyl*bi*Amin. Insoluble, or very sparingly soluble, in water. Soluble in boiling, less soluble in cold alcohol. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **53.** 310.)
(*Amide of Benzanilidyl.*)
$C_{26}H_{12}N_2 = N_2\left\{\begin{matrix} C_{12}H_4'' \\ C_{14}H_5 \\ H_3 \end{matrix}\right.$

PhenylAcetamin. Sparingly soluble in cold, tolerably soluble in boiling water. Tolerably soluble in alcohol, and ether. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **37.** 329.)
(*Acetanilid. AcetylPhenylamid.*)
$C_{16}H_9NO_2 = N\left\{\begin{matrix} C_4H_3O_2 \\ C_{12}H_5 \\ H \end{matrix}\right.$

PhenylAcetosamin. Insoluble in water. Readily soluble in absolute alcohol. Insoluble in ether. (Natanson, *Ann. Ch. u. Pharm.*, **98.** 298.)
(*AcetylAnilin. AcetoylAnilin. VinylAnilin. VinylPhenylamin.*)
$C_{16}H_9N = N\left\{\begin{matrix} C_{12}H_5 \\ C_4H_3 \\ H \end{matrix}\right.$

PhenylAconitamic Acid. Sparingly soluble in water. Easily soluble in alcohol.
(*AconitAnilic Acid.*)
$C_{24}H_9NO_8 = N\left\{\begin{matrix} C_{12}H_3O_6''' \\ C_{12}H_5 \end{matrix}\right. .O, HO$

Very easily soluble in dilute ammonia-water. (Pebal.)

PhenylAconitamate of Silver. Insoluble, or very sparingly soluble in water.
$C_{24}\,H_8\,Ag\,N\,O_8$

***Di*PhenylAconitimid.** (*AconitobiAnil.*) Insoluble in water. Sparingly soluble in boiling alcohol. (Pebal, *Ann. Ch. u. Pharm.*, **98.** 80.)

$$C_{36}\,H_{14}\,N_2\,O_6 = N_2\left\{\begin{matrix}C_{12}\,H_3\,O_6{}'''\\(C_{12}\,H_5)_2\\H\end{matrix}\right.$$

PhenylAllylUrea. (*AllylAnilin Urea.*)

$$C_{20}\,H_{12}\,N_2\,O_2 = N_2\left\{\begin{matrix}C_2\,O_2{}''\\C_6\,H_5\\C_{12}\,H_5\\H_2\end{matrix}\right.$$

Phenylamate of Ammonia. Soluble in water.

Phenylamate of Baryta. Readily soluble in water. Insoluble in an aqueous solution of chloride of ammonium.

Phenylamate of Lead. Soluble in water.

Phenylamate of Silver. Soluble in water.
$C_{20}\,H_{10}\,Ag\,N\,O_8$

Phenamid. *Vid.* Anilin.

PhenylAmin. *Vid.* Anilin.

***Tri*Phenylamin.** (*BiCinnamylamin. BiPhenanilin.*) Difficultly soluble in water. Readily soluble in alcohol, and ether. Its salts are easily decomposed, especially when in solution. (Gœssmann, *Ann. Ch. u. Pharm.*, **100.** 57.)

$$C_{36}\,H_{15}\,N = N\left\{(C_{12}\,H_5)_3\right.$$

Phenylammelin. (*Ammeline anilique.*) Soluble in warm, less soluble in cold dilute nitric acid. Insoluble in ammonia-water. (Laurent, *Ann. Ch. et Phys.*, (3.) **22.** 100.)
$C_{30}\,H_{13}\,N_5\,O_2$

PhenylAmmonia. *Vid.* Anilin.

PhenylAngelamid. (*Angelanilid.*)

PhenylAnisylamid. (*PhenylAnisamid. Anisanilid. ThianylAnisamid. Anilanisamid.*) Insoluble in water. Soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **23.** 353.)

$$C_{28}\,H_{13}\,N\,O_4 = N\left\{\begin{matrix}C_{16}\,H_7\,O_4\\C_{12}\,H_5\\H\end{matrix}\right.$$

PhenylBenzolamin. (*BenzoylAnilid. BenzoylAnilin. StilbylPhenylamin. StilbylAnilin.*) Insoluble in water. Very easily soluble in alcohol, and ether. Soluble, without apparent decomposition, in warm concentrated chlorhydric acid. Soluble, with decomposition, in concentrated sulphuric and nitric acids. Not perceptibly soluble in acetic acid. (Laurent & Gerhardt.)

$$C_{26}\,H_{11}\,N = N\left\{\begin{matrix}C_{14}\,H_6{}''\\C_{12}\,H_5\end{matrix}\right.$$

PhenylBenzoylamid. (*PhenylBenzamid. Benzanilid. Anilobenzamid. BenzoylPhenylamid.*) Insoluble in water. Soluble in alcohol, especially if this be warm. Unacted upon by weak acids, or by alkaline solutions, even boiling. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **15.** 96.) Easily soluble in alcohol, and ether.

$$C_{26}\,H_{11}\,N\,O_2 = N\left\{\begin{matrix}C_{14}\,H_5\,O_2\\C_{12}\,H_5\\H\end{matrix}\right.$$

Phenyl*di*Benzoylamid. (*PhenyldiBenzamid. BiBenzoylanilid. DiBenzanilid. DiBenzoylPhenylamid.*) Sparingly soluble in boiling, and still less soluble in cold water; somewhat more readily soluble in warm ammonia-water, separating out again on cooling. Tolerably easily soluble in absolute alcohol, and in ether. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 138.) Only sparingly soluble in cold, more readily soluble in boiling alcohol.

$$C_{40}\,H_{15}\,N\,O_4 = N\left\{\begin{matrix}(C_{14}\,H_5\,O_2)_2\\C_{12}\,H_5\end{matrix}\right.$$

PhenylBromImesatin. Almost insoluble in water. Easily soluble in boiling, less soluble in cold alcohol.
$C_{28}\,H_9\,Br\,N_2\,O_2$

PhenylButyramid. (*ButyrylPhenylamid. Butyranilid.*) Insoluble in water. Easily soluble in alcohol (spirit), and ether. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **37.** 330.)

$$C_{20}\,H_{13}\,N\,O_2 = N\left\{\begin{matrix}C_8\,H_7\,O_2\\C_{12}\,H_5\\H\end{matrix}\right.$$

PhenylCamphoric Acid. (*CamphorAnilic Acid. CamphorAnilidic Acid. Anilo Camphoraminic Acid. PhenylCamphorylaminic Acid.*) Very sparingly soluble in boiling water. Readily soluble in alcohol, even when very dilute, and ether. Soluble in dilute ammonia-water. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 194.)

$$C_{32}\,H_{21}\,N\,O_8 = N\left\{\begin{matrix}C_{20}\,H_{14}\,O_4{}''\\C_{12}\,H_5\\H\end{matrix}\right.\;.\;O,\,H\,O$$

PhenylCamphorate of

Ammonia. **Baryta.** **Lime.**	Soluble in water.

PhenylCamphorate of Silver. Sparingly soluble in water. (L. & G.)
$C_{32}\,H_{20}\,Ag\,N\,O_8$

PhenylCamphorimid. (*PhenylCamphorylamid. Camphoranil. AniloCamphorimid.*) Insoluble in cold, sparingly soluble in boiling water. Readily soluble in alcohol, and ether. Soluble in boiling, less soluble in cold dilute alcohol. Insoluble in ammonia-water. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 191.)

$$C_{32}\,H_{19}\,N\,O_4 = N\left\{\begin{matrix}C_{20}\,H_{14}\,O_4{}''\\C_{12}\,H_5\end{matrix}\right.$$

PhenylCamphorimid with Silver. Ppt.

$$N\left\{\begin{matrix}C_{20}\,H_{13}\,Ag\,O_4{}''\\C_{12}\,H_5\end{matrix}\right.$$

PhenylCarbamic Acid. (*Carbanilic Acid. AmidoBenzoic Acid. CarbonylPhenylaminic Acid. Anthranilic Acid. Isomeric with Benzamic Acid.*) Only slightly soluble in cold, much more soluble in boiling water. Readily soluble in alcohol, and ether. The alkaline phenylcarbamates are readily soluble in water, and alcohol. (Fritzsche.)

$$C_{14}\,H_7\,N\,O_4 = N\left\{\begin{matrix}C_2\,O_2{}''\\C_{12}\,H_5\\H\end{matrix}\right.\;.\;O,\,H\,O$$

PhenylCarbamate of Copper. Ppt.

"**PhenylCarbamate of Ethyl.**" *Vid.* Benzamate of Ethyl.

PhenylCarbamate of Lead. Ppt.

PhenylCarbamate of Lime. Slightly soluble in cold, tolerably readily soluble in hot water. (Liebig.)
$C_{14}\,H_6\,Ca\,N\,O_4$

"**PhenylCarbamate of Methyl.**" *Vid.* Benzamate of Methyl.

PhenylCarbamate of Silver. Soluble in boiling, less soluble in cold water. (Liebig.) Tolerably soluble in hot, less soluble in cold water; more readily soluble in alcohol, and ether. (Chancel.)
$C_{14}\,H_6\,Ag\,N\,O_4$

PhenylCarbamate of Zinc.

PhenylCarbamid. (*Carbanilamid. Anilin Urea. Carbamid Carbanilid. Abnormal Cyanate of Anilin.*) Sparingly soluble in cold, abundantly soluble in boiling water. Very soluble in alcohol and in ether. Soluble, without decomposition,

$$C_{14}\,H_8\,N_2\,O_2 = N_2\left\{\begin{matrix}C_2\,O_2{}''\\C_{12}\,H_5\\H_3\end{matrix}\right.$$

in monohydrated sulphuric acid, but the solution is decomposed by heating. Soluble, without alteration, in nitric acid, but scarcely more readily in dilute nitric or oxalic acid than in water. It is not decomposed by boiling with dilute acids or alkalies. (Hofmann, *J. Ch. Soc.*, **2.** 39.)

***Di*PhenylCarbamid.** (*Carbanilid. Anilo Carbamid.*) $C_{26}H_{12}N_2O_2 = N_2\left\{\begin{matrix}C_2O_2''\\(C_{12}H_5)_2\\H_2\end{matrix}\right.$ Very slightly soluble in water; more readily soluble in alcohol, and ether. (Hofmann, *J. Ch. Soc.*, **2.** 43.)

PhenylCarbimid. *Vid.* Cyanate of Phenyl.

PhenylCetylamin. *Vid.* CetylAnilin.

PhenylChlorImesatin. $C_{28}H_9ClN_2O_2$ Very difficultly soluble in water. Very easily soluble in boiling, and tolerably soluble in cold alcohol.

PhenylChloroCyanamid. (*ChloroCyanilide.*) $C_{30}H_{12}N_5Cl$ Insoluble in water. Sparingly soluble in boiling, and still less soluble in cold alcohol. (Laurent, *Ann. Ch. et Phys.*, (3.) **22.** 99.)

PhenylCinnamylamid. (*PhenylCinnamid. Cinnanilid. Anilo Cinnamid.*) $C_{30}H_{13}NO_2 = N\left\{\begin{matrix}C_{18}H_7O_2\\C_{12}H_5\\H\end{matrix}\right.$ Insoluble, or very sparingly soluble in water. Easily soluble in warm, much less soluble in cold alcohol. Scarcely at all acted upon by strong alkaline solutions. (Cahours, *Ann. Ch. et Phys.*, (3.) **23.** 344.)

PhenylCitraconamic Acid. (*CitraconAnilic Acid. Citraconanilidsæure. CitraconylPhenylamic Acid.*) $C_{22}H_{11}NO_6 = N\left\{\begin{matrix}C_{10}H_4O_4''\\C_{12}H_5\\H\end{matrix}\right. .O, HO$ Very sparingly soluble in cold water, the aqueous solution undergoing decomposition when boiled. Soluble in a mixture of alcohol and ether.

PhenylCitraconamate of Ammonia. Soluble in water.

PhenylCitraconamate of Silver. Ppt. Decomposed by boiling water.

PhenylCitraconimid. (*Citraconanil. CitraconylPhenylamid.*) $C_{22}H_9NO_4 = N\left\{\begin{matrix}C_{10}H_4O_4''\\C_{12}H_5\end{matrix}\right.$ Sparingly soluble in water. Readily soluble in alcohol, and ether. Soluble, without decomposition, in cold concentrated sulphuric acid, from which it is precipitated on the addition of water.

PhenylCitramic Acid. (*CitrAnilic Acid. CitromonAnilic Acid. CitrAnilidic Acid. Phenyl Citrylamic Acid.*) $C_{24}H_{11}NO_{10} = N\left\{\begin{matrix}C_{12}H_5O_8'''\\C_{12}H_5\end{matrix}\right. .O, HO$ Easily soluble in water, and alcohol. (Pebal.)

PhenylCitramate of Anilin. $C_{24}H_{10}\left(N\left\{\begin{matrix}C_{12}H_5\\H_2.H\end{matrix}\right.\right)O_{10}$ Very soluble in alcohol. (Pebal.)

PhenylCitramate of Silver.

I.) $C_{24}H_{10}AgNO_{10}$ Ppt., in alcohol.

II.) *basic.* $C_{24}H_{10}AgNO_{10}; AgO, HO$ Insoluble, or very sparingly soluble, in water.

PhenylCitramid. (*Citranilide. triPhenylCitryltriamide.*) $C_{48}H_{23}N_3O_8 = N_3\left\{\begin{matrix}C_{12}H_5O_8'''\\(C_{12}H_5)_3\\H_3\end{matrix}\right.$ Scarcely at all soluble in water. Sparingly soluble in boiling, and still less soluble in cold alcohol. Insoluble in boiling aqueous solutions of caustic ammonia or potash.

PhenylCitrimid. (*CitrobiAnil. Citranilimid. DiPhenylCitryldiamid.*) $C_{36}H_{16}N_2O_8 = N_2\left\{\begin{matrix}C_{12}H_5O_8'''\\(C_{12}H_5)_2\\H\end{matrix}\right.$ Permanent. Very slightly soluble in water. Very readily soluble in boiling alcohol. (Pebal.)

PhenylCitro*bi*amic Acid. (*Citrobianilic Acid. Citrobianilidic Acid. diPhenylCitrylbiamic Acid.*) $C_{36}H_{18}N_2O_{10} = N_2\left\{\begin{matrix}C_{12}H_5O_8'''\\C_{12}H_5\\C_{12}H_5.H\\H\end{matrix}\right. .O, HO$ Slightly soluble in water. Readily soluble in alcohol. Very easily soluble in spirit, and in ammonia-water. (Pebal, *Ann. Ch. u. Pharm.*, **98.** 90.)

PhenylCitro*bi*amate of Ammonia. Soluble in water.

PhenylCitro*bi*amate of Anilin. $C_{36}H_{17}\left(N\left\{\begin{matrix}C_{12}H_5\\H_2.H\end{matrix}\right.\right)N_2O_{10}$ Soluble in water.

PhenylCitro*bi*amate of Baryta. $C_{36}H_{17}BaN_2O_{10}$ Ppt. Insoluble, or nearly insoluble, in water.

PhenylCitro*bi*amate of Silver. $C_{36}H_{17}AgN_2O_{10}$ Insoluble in water.

PhenylCuminamid. (*Phenyl Cumylamid. CuminAnilid. Anilo Cuminamid. Cumanilid.*) $C_{32}H_{17}NO_2 = N\left\{\begin{matrix}C_{20}H_{11}O_2\\C_{12}H_5\\H\end{matrix}\right.$ Insoluble, or very sparingly soluble, in water. Sparingly soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **23.** 349.)

PhenylCaprylamid. (*CaprylAnilid. CaprylPhenylamid.*) $C_{28}H_{21}NO_2 = N\left\{\begin{matrix}C_{16}H_{15}O_2\\C_{12}H_5\\H\end{matrix}\right.$

PhenylCyanamid. *Vid.* CyanAnilid.

PhenylEthyl Compounds. *Vid.* EthylPhenyl Compounds.

PhenylFormylamid. (*PhenylFormiamid. Formanilid. AniloFormamid.*) $C_{14}H_7NO_2 = N\left\{\begin{matrix}C_{12}H_5\\C_2HO_2\\H\end{matrix}\right.$ Tolerably readily soluble in water, especially when this is warm; still more soluble in alcohol. Unacted upon by cold, but decomposed by boiling dilute aqueous solutions of caustic potash, and sulphuric acid. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **14.** 122, & (3.) **15.** 94.) Soluble in ether.

Phenylic Acid. *Vid.* Phenic Acid.

Phenylide of Benzoyl. *Vid.* BenzoPhenone.

Phenylide of SulphoPhenyl. *Vid.* SulphoBenzid.

PhenylImesatin. (*PhenylIsatoylbiamid.*) $C_{28}H_{10}N_2O_2 = N_2\left\{\begin{matrix}C_{16}H_2O_2''\\C_{12}H_5\\H_3\end{matrix}\right.$ Very slightly soluble in boiling water, from which it separates as the solution cools. Readily soluble in boiling, much less soluble in cold alcohol. Soluble in ether, and in concentrated sulphuric acid. (Engelhardt.)

PhenylItaconamic Acid. (*ItaconAnilic Acid. ItaconAnilidic Acid. ItaconylPhenylamic Acid.*) $C_{22}H_{11}NO_6 = N\left\{\begin{matrix}C_{10}H_4O_4''\\C_{12}H_5\\H\end{matrix}\right. .O, HO$ Easily soluble in water; still more readily soluble in alcohol. (Gottlieb.)

PhenylItaconamate of Ammonia.

I.) *acid.* Sparingly soluble in hot water.

PhenylItaconamate of Baryta. $C_{22}H_{10}BaNO_6$ Very soluble in water.

PhenylItaconamate of Copper. Ppt.
$C_{22}\,H_{10}\,Cu\,N\,O_6$

PhenylItaconamate of Lead. Ppt.

PhenylItaconamate of Silver. Easily soluble, with partial decomposition, in boiling water.
$C_{22}\,H_{10}\,Ag\,N\,O_6$

PhenylItaconamate of Soda. Very readily soluble in water. (Gottlieb.)

PhenylItaconamid. Almost insoluble in cold, very sparingly soluble in boiling water. Easily soluble in alcohol, and ether. Soluble, without decomposition, in concentrated sulphuric acid, from which solution it is precipitated on the addition of water. Unacted upon by dilute acids or alkaline solutions. (Gottlieb.)
(*ItaconylPhenylbiamid. Itaconanilid.*)
$C_{34}\,H_{16}\,N_2\,O_4 = N_2\left\{\begin{matrix} C_{10}\,H_4\,O_4 \\ (C_{12}\,H_5)_2 \\ H_2 \end{matrix}\right.$

PhenylMalamic Acid. Readily soluble in water. Soluble in alcohol. Sparingly soluble in ether. Its salts are generally very readily soluble in water. (Arppe, *Ann. Ch. u. Pharm.*, **96.** 111.)
(*MalAnilic Acid. MalAnilidic Acid. MalylPhenamic Acid.*)
$C_{20}\,H_{11}\,N\,O_8 = N\left\{\begin{matrix} C_8\,H_4\,O_6^{\prime\prime} \\ C_{12}\,H_5 \\ H \end{matrix}\right. .\,O,\,H\,O$

PhenylMalamate of Ammonia. Soluble in water.

PhenylMalamate of Baryta. Tolerably soluble in water. Insoluble in an aqueous solution of chloride of ammonium.

PhenylMalamate *of sesquioxide* of Iron. Ppt.

PhenylMalamate of Lead. Somewhat soluble in water.

PhenylMalamate of Lime. Soluble in water.

PhenylMalamate of Silver. Somewhat soluble in boiling, less soluble in cold water. (Arppe.)
$C_{20}\,H_{10}\,Ag\,N\,O_8$

***Di*PhenylMalamid.** Nearly insoluble in water. Soluble in boiling, sparingly soluble in cold alcohol. Sparingly soluble in ether. Nearly insoluble in chlorhydric acid, ammonia-water, or a dilute solution of caustic potash; decomposed by a strong solution of potash. Soluble in warm concentrated sulphuric acid, and in cold nitric acid. (Arppe, *Ann. Ch. u. Pharm.*, **96.** 108.)
(*Malanilid. MalyldiPhenylbiamid.*)
$C_{32}\,H_{16}\,N_2\,O_6 = N_2\left\{\begin{matrix} C_8\,H_4\,O_6^{\prime\prime} \\ (C_{12}\,H_5)_2 \\ H_2 \end{matrix}\right.$

PhenylMalimid. Soluble in great quantity in boiling water. Also soluble in alcohol, and ether. Abundantly soluble, with combination, in nitric acid. (Arppe, *Ann. Ch. u. Pharm.*, **96.** 109.)
(*MalAnil. MalylPhenylamid.*)
$C_{20}\,H_9\,N\,O_6 = N\left\{\begin{matrix} C_8\,H_4\,O_6^{\prime\prime} \\ C_{12}\,H_5 \end{matrix}\right.$

PhenylNaphthylSulphoCarbamid. *Vid.* SulphoCyanide of PhenylNaphthylamin.

PhenylNitroBenzamid. *Vid.* NitroBenzanilid.

PhenylOxaluramid. Insoluble in boiling water. Almost insoluble in boiling alcohol. Easily soluble in concentrated sulphuric acid. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 178.)
(*Oxaluranilid. Aniloxuramid. CarbonylOxalylPhenylureamid.*)
$C_{18}\,H_9\,N_3\,O_6 = N_3\left\{\begin{matrix} C_2\,O_2^{\prime\prime} \\ C_4\,O_4^{\prime\prime} \\ C_{12}\,H_5 \\ H_4 \end{matrix}\right.$

PhenylOxamic Acid. Sparingly soluble in cold, readily soluble, without decomposition, in boiling water. Very soluble in alcohol. Decomposed by boiling with a dilute aqueous solution of caustic potash, or with dilute sulphuric or chlorhydric acid. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 168.)
(*Oxanilic Acid. Oxanilidic Acid. Aniloxamic Acid. OxalylPhenylamic Acid.*)
$C_{16}\,H_7\,N\,O_6 = N\left\{\begin{matrix} C_4\,O_4^{\prime\prime} \\ C_{12}\,H_5 \\ H \end{matrix}\right. .\,O,\,H\,O$

Its salts are all sparingly soluble in cold, but easily soluble in hot water.

PhenylOxamate of Ammonia.

I.) *normal.* Sparingly soluble in cold, very soluble in boiling water. Very soluble in boiling, somewhat sparingly soluble in cold alcohol. (L. & G.)
$C_{16}\,H_6\,(N\,H_4)\,N\,O_6$

II.) *acid.* Sparingly soluble in cold water. (L. & G.)
$C_{16}\,H_6\,(N\,H_4)\,N\,O_6,\;C_{16}\,H_7\,N\,O_6$

PhenylOxamate of Anilin.

I.) *acid.* Sparingly soluble in cold, readily soluble in hot water. Soluble, without decomposition, in chlorhydric acid. (L. & G.)
$C_{16}\,H_6\left(N\left\{\begin{matrix} C_{12}\,H_5 \\ H_2\,.\,H \end{matrix}\right.\right)N\,O_6,\;C_{16}\,H_7\,N\,O_6$

PhenylOxamate of Baryta. Sparingly soluble in hot, almost insoluble in cold water. (L. & G.)
$C_{16}\,H_6\,Ba\,N\,O_6$

PhenylOxamate of Lime. Soluble in hot, rather sparingly soluble in cold water. (L. & G.)
$C_{16}\,H_6\,Ca\,N\,O_6$

PhenylOxamate of Silver. Abundantly soluble in hot, almost insoluble in cold water. (L. & G.)
$C_{16}\,H_6\,N\,Ag\,O_6$

PhenylOxamid. Almost insoluble in cold, easily soluble in boiling water. Soluble in boiling, somewhat less soluble in cold, concentrated alcohol. Less soluble in alcohol than in water. Soluble in ether. Soluble in concentrated aqueous solutions of the caustic alkalies, the solution undergoing decomposition after a time. (Hofmann, *J. Ch. Soc.*, **2.** 302.)
(*Oxanilamid. Oxamide Oxanilid. OxalylPhenylbiamid.*)
$C_{16}\,H_8\,N_2\,O_4 = N_2\left\{\begin{matrix} C_4\,O_4^{\prime\prime} \\ C_{12}\,H_5 \\ H_3 \end{matrix}\right.$

***Di*PhenylOxamid.** Insoluble in water, even when this is boiling. Insoluble in cold, very sparingly soluble in boiling alcohol. Insoluble in ether. Unacted upon by boiling dilute alkaline solutions, or dilute acids. Decomposed by boiling concentrated solutions of caustic potash, and of concentrated sulphuric acid. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **14.** 121, & (3.) **15.** 92.) Insoluble in water. Very difficultly soluble in alcohol; more readily, though still sparingly, soluble in benzin. (Hofmann, *J. Ch. Soc.*, **2.** 301.)
(*Oxanilid. Aniloxamid. OxalyldiPhenylbiamid.*)
$C_{28}\,H_{12}\,N_2\,O_4 = N_2\left\{\begin{matrix} C_4\,O_4^{\prime\prime} \\ (C_{12}\,H_5)_2 \\ H_2 \end{matrix}\right.$

***Tri*PhenylPhosphamid.** Insoluble in water. Soluble, with decomposition, in concentrated sulphuric acid.
(*Phosphanilid. PhosphoryltriPhenyltriamid.*)
$C_{36}\,H_{18}\,N_3\,P\,O_2 = N_3\left\{\begin{matrix} P\,O_2^{\prime\prime\prime} \\ (C_{12}\,H_5)_3 \\ H_3 \end{matrix}\right.$

PhenylPhtalamic Acid. Very sparingly soluble in cold, more soluble in warm water. Easily soluble in al-
(*PhtalAnilic Acid. PhthalAnilidic Acid. AniloPhtalamic Acid.*)
$C_{28}\,H_{11}\,N\,O_6 = N\left\{\begin{matrix} C_{16}\,H_4\,O_4^{\prime\prime} \\ C_{12}\,H_5 \\ H \end{matrix}\right. .\,O,\,H\,O$

cohol, and ether. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 190.)

PhenylPhtalamate of Ammonia. Soluble in water.

PhenylPhtalamate of Baryta. Appears to be soluble in water.

PhenylPhtalamate of Lead. Ppt.

PhenylPhtalamate of Lime. Appears to be soluble in water.

PhenylPhtalamate of Silver. Ppt.

PhenylPhtalimid. Insoluble in water. Soluble in boiling, less soluble in cold alcohol. Decomposed by boiling ammonia-water. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 189.)

(*PhtalAnil. PhtalPhenylimid.*)

$$C_{28}\,H_9\,N\,O_4 = N\left\{\begin{array}{l}C_{16}\,H_4\,O_4''\\C_{12}\,H_5\end{array}\right.$$

PhenylPyroTartramic Acid. Somewhat sparingly soluble in water, though more soluble than phenylpyrotartrimid. Easily soluble in alcohol, ether, and acids.

(*Pyrotartranilic Acid. Pyrotartranilidic Acid. Pyrotartanilic Acid. Pyrotartrylphenylamic Acid.*)

$$C_{22}\,H_{13}\,N\,O_6 = N\left\{\begin{array}{l}C_{10}\,H_6\,O_4''\\C_{12}\,H_5\\H\end{array}\right. .\,O,H\,O$$

Its salts of the alkalies and alkaline earths are readily soluble in water; those of the metallic oxides are difficultly soluble. (Arppe, *Ann. Ch. u. Pharm.*, **90.** 142.)

PhenylPyroTartramate of Ammonia. Readily soluble in cold water. Decomposed by boiling water.

PhenylPyroTartramate of Baryta. Soluble in water.

PhenylPyroTartramate of Copper. Ppt.

PhenylPyroTartramate *of peroxide* of Iron. Ppt.

PhenylPyroTartramate of Lead. Soluble in boiling water and in a solution of acetate of lead.

$C_{10}\,H_7\,Pb\,(C_{12}\,H_5)\,N\,O_6$

PhenylPyroTartramate of Lime. Soluble in water.

PhenylPyroTartramate of Mercury (Hg O). Ppt.

PhenylPyroTartramate of Potash. Very easily soluble in water.

PhenylPyroTartramate of Silver. Soluble in boiling water.

$C_{22}\,H_{12}\,Ag\,N\,O_6$

PhenylPyroTartramate of Soda. Soluble in water.

PhenylPyroTartrimid. Sparingly soluble in boiling water. Easily soluble in alcohol, even in weak spirit, and in ether. Easily soluble in acids. Soluble in cold alkaline solutions, with alteration, the solution being decomposed on heating. (Arppe, *Ann. Ch. u. Pharm.*, **90.** 139.) Sparingly soluble in cold water. Easily soluble in boiling alcohol. (Biffi.)

(*Pyrotartranil. Pyrotartranil. Pyrotartrylphenylamid.*)

$$C_{22}\,H_{11}\,N\,O_4 = \left\{\begin{array}{l}C_{10}\,H_6\,O_4''\\C_{12}\,H_5\end{array}\right.$$

PhenylSalicoylamid. Insoluble in water. Easily soluble in alcohol. Decomposed by warm acids and alkaline solutions. (Schischkoff.)

(*Salicylanilid. Isomeric with PhenylBenzoylamid.*)

$$C_{26}\,H_{11}\,N\,O_2 = N\left\{\begin{array}{l}C_{14}\,H_5\,O_2\\C_{12}\,H_5\\H\end{array}\right.$$

PhenylStearamid.

(*StearAnilid.*)

$$C_{48}\,H_{41}\,N\,O_2 = N\left\{\begin{array}{l}C_{36}\,H_{35}\,O_2\\C_{12}\,H_5\\H\end{array}\right.$$

PhenylSuberamic Acid. Insoluble in cold, sparingly soluble in warm water. Easily soluble in alcohol, and ether. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 186.)

(*SuberAnilic Acid. AniloSuberamic Acid.*)

$$C_{28}\,H_{19}\,N\,O_6 = N\left\{\begin{array}{l}C_{16}\,H_{12}\,O_4''\\C_{12}\,H_5\\H\end{array}\right. .\,O,H\,O$$

PhenylSuberamate of Ammonia. Tolerably soluble in water. (L. & G.)

PhenylSuberamate of Baryta. Soluble in boiling, but sparingly soluble in cold water. (L. & G.)

PhenylSuberamate of Copper. Insoluble in water. (L. & G.)

PhenylSuberamate *of protoxide* of Iron. Ppt.

PhenylSuberamate of Lead. Insoluble in water. (L. & G.)

PhenylSuberamate of Lime. Soluble in warm, less soluble in cold water. (L. & G.)

PhenylSuberamate of Silver. Insoluble in water. (L. & G.)

$C_{28}\,H_{18}\,Ag\,N\,O_6$

*Di*PhenylSuberamid. Entirely insoluble in water. Very sparingly soluble in cold, easily soluble in hot alcohol. Easily soluble in hot ether. Insoluble in boiling ammonia-water. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 184.)

(*SuberAnilid. DiPhenylSuberylbiamid.*)

$$C_{40}\,H_{24}\,N_2\,O_4 = N_2\left\{\begin{array}{l}C_{16}\,H_{12}\,O_4''\\(C_{12}\,H_5)_2\\H_2\end{array}\right.$$

PhenylSuberimid (?). Sparingly soluble in boiling, less soluble in cold alcohol, and ether. Insoluble in boiling aqueous solutions of caustic potash or ammonia. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 187.)

(*SuberAnil(?).*)

PhenylSuccinamic Acid. Very sparingly soluble in cold, more soluble in warm water. Very readily soluble in alcohol, and ether. Soluble in alkaline solutions. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 181.)

(*SuccinAnilic Acid. SuccinAnilidic Acid. AniloSuccinamic Acid. SuccinylPhenylamic Acid.*)

$$C_{20}\,H_{11}\,N\,O_6 = N\left\{\begin{array}{l}C_8\,H_4\,O_4''\\C_{12}\,H_5\\H\end{array}\right. .\,O,H\,O$$

PhenylSuccinamate of Ammonia. Tolerably readily soluble in water.

PhenylSuccinamate of Baryta. Easily soluble in warm water. (L. & G.)

PhenylSuccinamate of Copper. Insoluble in water.

PhenylSuccinamate *of protoxide* of Iron. Sparingly soluble in water.

PhenylSuccinamate of Lime. Appears to be soluble in water.

PhenylSuccinamate of Silver. Insoluble in water. (L. & G.)

$C_{20}\,H_{10}\,Ag\,N\,O_6$

*Di*PhenylSuccinamid. Insoluble in water. Easily soluble in boiling, less soluble in cold alcohol. Easily soluble in ether. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 182.)

(*SuccinAnilid. AniloSuccinamid. SuccinyldiPhenylbiamid.*)

$$C_{32}\,H_{16}\,N_2\,O_4 = N_2\left\{\begin{array}{l}C_8\,H_4\,O_4''\\(C_{12}\,H_5)_2\\H_2\end{array}\right.$$

PhenylSuccinimid. Insoluble in cold, somewhat soluble in boiling water. Easily soluble in alcohol and ether, and in nitric, and chlorhydric acids. Soluble, with decompo-

(*SuccinAnil. AniloSuccinimid. SuccinylPhenylamid.*)

$$C_{20}\,H_9\,N\,O_4 = N\left\{\begin{array}{l}C_8\,H_4\,O_4''\\C_{12}\,H_5\end{array}\right.$$

sition, in boiling ammonia-water. Unacted on by an aqueous solution of caustic potash. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24.** 180.)

PhenylSulphamic Acid. *Vid.* SulphAnilic Acid.

PhenylSulphuric Acid. Soluble in water. (*SulphoPhenic Acid. SulphoCarbolic Acid. Sulphate of Phenyl.*) $C_{12}H_6S_2O_8 = C_{12}H_5O, HO, 2SO_3$

PhenylSulphate of Ammonia. $C_{12}H_5(NH_4)S_2O_8 + Aq$

PhenylSulphate of Baryta. $C_{12}H_5BaS_2O_8 + 3Aq$ Soluble in water, and in boiling alcohol.

PhenylSulphurous Acid. Easily soluble in water. Its salts are soluble in water. (*SulphoBenzolic Acid. Sulphophenylic Acid. Sulphobenzidic Acid. Benzosulphuric Acid.*) $C_{12}H_6S_2O_6 = C_{12}H_5O, HO, S_2O_4$

PhenylSulphite of Ammonium. Soluble in water.

PhenylSulphite of Anilin. $C_{12}H_5\left(N\left\{\begin{array}{l}C_{12}H_5\\H_3\end{array}\right.\right)S_2O_6$ Easily soluble in water, and alcohol. Scarcely at all soluble in ether. (Gericke, *Ann. Ch. u. Pharm.*, **100.** 217.)

PhenylSulphite of Baryta. $C_{12}H_5BaS_2O_6$ Easily soluble in water, and alcohol. (Gericke.)

PhenylSulphite of Copper. $C_{12}H_5CuS_2O_6$ Easily soluble in water, and alcohol. (Gericke.)

PhenylSulphite of Ethyl. $C_{12}H_5(C_4H_5)S_2O_6$ Easily soluble in water; less soluble in spirit. When quickly evaporated, the aqueous solution undergoes decomposition. (Gericke.)

PhenylSulphite of Lead. Easily soluble in water, and alcohol. (Gericke.)

PhenylSulphite of Lime. Easily soluble in water, and alcohol. (Gericke.)

PhenylSulphite of Potash. Soluble in water.

PhenylSulphite of Silver. Soluble in water. (Laurent, *Method*, p. 250.)

PhenylSulphite of Soda. Easily soluble in water, and alcohol. (Gericke.)

PhenylSulphite of Zinc. Easily soluble in water, and alcohol. (Gericke.)

***Di*PhenylSulphoBenzoylbiamid.** Difficultly soluble in hot, and almost insoluble in cold water. (*SulphoBenzanilid.*) $C_{38}H_{16}N_2S_2O_8 = N_2\left\{\begin{array}{l}C_{14}H_4S_2O_6''\\(C_{12}H_5)_2\\H_2\end{array}\right.$ Easily soluble in hot alcohol, and ether. Unacted upon by cold, but decomposed by boiling potash-lye. (Limpricht & v. Uslar, *Ann. Ch. u. Pharm.*, **102.** 258.)

PhenylSulphoCarbamid. Soluble in water. (*SulphoCarbonylPhenylbiamid.*) $C_{14}H_8N_2S_2 = N_2\left\{\begin{array}{l}C_2S_2''\\C_{12}H_5\\H_3\end{array}\right.$

***Di*PhenylSulphoCarbamid.** Only slightly soluble in water; more readily soluble in alcohol, and ether, especially when these are warm. (*SulphoCarbanilid. SulphoCarbonyldiPhenylbiamid.*) $C_{26}H_{12}N_2S_2 = N_2\left\{\begin{array}{l}C_2S_2''\\(C_{12}H_5)_2\\H_2\end{array}\right.$ Soluble in cold concentrated sulphuric acid. (Hofmann, *J. Ch. Soc.*, **2.** 50.)

PhenyldiSulphodiamic Acid. *Vid. bi*ThioBenzolic Acid.

PhenylSulphoPhenylamid. *Vid.* SulphoPhenAnilid.

PhenylSulphurousPhenylid. *Vid.* SulphoBenzid.

PhenylTartrylamic Acid. Easily soluble in water, and alcohol; much less readily soluble in ether. (*Phenyl Tartramic Acid. Tartranilic Acid. Turtanilic Acid. Tartranilidic Acid.*) $C_{20}H_{11}NO_{10} = N\left\{\begin{array}{l}C_8H_4O_8''\\C_{12}H_5\\H\end{array}\right.\cdot O, HO$ (Arppe, *Ann. Ch. u. Pharm.*, **93.** 355.)

PhenylTartrylamate of Ammonia. Efflorescent. Very easily soluble in water. (Arppe, *loc. cit.*)

PhenylTartrylamate of Baryta. $C_{20}H_{10}BaO_{10}$ Tolerably soluble in boiling, less soluble in cold water. (Arppe, *loc. cit.*)

PhenylTartrylamate of Silver. $C_{20}H_{10}AgO_{10}$ Somewhat soluble in water. (Arppe, *loc. cit.*)

PhenylTartrylamid. Very easily soluble in water, and alcohol. (*Tartranil. Tartanil.*) $C_{20}H_9NO_8 = N\left\{\begin{array}{l}C_8H_4O_8''\\C_{12}H_5\end{array}\right.$ (Arppe, *Ann. Ch. u. Pharm.*, **93.** 354.)

***Di*PhenylTartryl*bi*amin.** Insoluble in water. Somewhat sparingly soluble in boiling alcohol. Difficultly soluble in ether. (*Tartranilid. Tartanilid*) $C_{32}H_{16}N_2O_8 = N_2\left\{\begin{array}{l}C_8H_4O_8''\\(C_{12}H_5)_2\\H_2\end{array}\right.$ Easily soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water. Difficultly soluble in hot chlorhydric acid. Partially decomposed by hot nitric acid. Soluble in aqueous solutions of the caustic alkalies. (Arppe, *Ann. Ch. u. Pharm.*, **93.** 353.)

PhenylThiosinamin. Insoluble in water. Readily soluble in alcohol, and ether, even in the cold. Soluble, without decomposition, in concentrated chlorhydric acid, from which it is precipitated on the addition of water; also soluble in alcoholic solutions of chlorhydric and sulphuric acids, from which it may be recrystallized unchanged. (*AllylSulpho Carbanilide. AllylPhenylSulphoCarbamid. SulphoCarbonylAllylPhenylbiamid.*) $C_{20}H_{12}N_2S_2 = N_2\left\{\begin{array}{l}C_2S_2''\\C_{12}H_5\\C_6H_5\\H_2\end{array}\right.$

PhenylUrea. Soluble in water, alcohol, and ether. (Chancel.) The alcoholic and ethereal solutions soon undergo decomposition; but the aqueous solution may be preserved unaltered. (*Anilic Urea. CarbAnilamid. BasicCarbonylPhenylbiamid.*) $C_{14}H_8N_2O_2 + 2Aq = N_2\left\{\begin{array}{l}C_2O_2''\\C_{12}H_5\\H_3\end{array}\right. + 2Aq$

***Di*PhenylUrea.** Almost insoluble in water. Soluble in alcohol, and ether. (Laurent & Chancel.) (*Flavin. BasicCarbonyldiPhenylamid.*) $C_{26}H_{12}N_2O_2 = N_2\left\{\begin{array}{l}C_2O_2''\\(C_{12}H_5)_2\\H_2\end{array}\right.$

PhenylValeramid. Sparingly soluble in boiling water. Readily soluble in alcohol, even weak, and in ether. (*ValerylPhenylamid. Valeranilid.*) $C_{22}H_{15}NO_2 = N\left\{\begin{array}{l}C_{12}H_5\\C_{10}H_9O_2\\H\end{array}\right.$ (Chiozza, *Ann. Ch. et Phys.*, (3.) **39.** 201.)

Phillyrin. Sparingly soluble in cold, tol-

$C_{54}H_{37}O_{25} = \left.\begin{matrix} C_{42}H_{23}O_{10} \\ C_{12}H_{11}O_{10} \end{matrix}\right\} O_2 + 3\,Aq$

erably easily soluble in boiling water. Easily soluble in alcohol. Very sparingly soluble in ether. No more soluble in dilute acid or alkaline solutions than in pure water. Soluble in concentrated sulphuric acid; decomposed by boiling chlorhydric and nitric acids. Soluble in hydrate of anisyl. (Bertagnini, *Ann. Ch. u. Pharm.*, **92.** 110.) Insoluble in volatile or fatty oils. (Carbonieri.)

Phillygenin. Insoluble in cold, very sparingly soluble in boiling water. Easily soluble in alcohol, and ether. (Bertagnini, *Ann. Ch. u. Pharm.*, **92.** 111.)

$C_{42}H_{24}O_{12}$

Philobaphene. Permanent. Insoluble in water. When recently prepared, it is soluble in alcohol, but after having become dry it is insoluble in alcohol. Slightly soluble in acetic acid, but is insoluble in other dilute acids. Readily soluble in aqueous alkaline solutions.

$C_{20}H_8O_8$

Phloramin. Permanent in dry air. Sparingly soluble in cold water. Readily soluble in alcohol. Insoluble in ether. Soluble in acids, with combination.

$C_{12}H_7NO_4$

Phloretic Acid (of Stass). *Vid.* NitroPhloretin.

Phloretic Acid. Permanent. Soluble in water, though somewhat less soluble therein than in alcohol. Easily soluble in ether, even when this is cold. Insoluble in cold, decomposed by boiling chlorhydric acid. Soluble in concentrated sulphuric, and nitric acids. (Hlasiwetz.)

(*Phloretylic Acid.*)

$C_{18}H_{10}O_6 = C_{18}H_8O_4, 2\,HO$

Phloretate of Amyl. *Vid.* AmylPhloretic Acid.

Phloretate of Baryta.

I.) *normal.* Sparingly soluble in cold, somewhat more soluble in hot water. (Hlasiwetz.)

$C_{18}H_8Ba_2O_6 + 5\,Aq$

II.) *acid.* Soluble in water.

$C_{18}H_9BaO_6$

Phloretate of Copper.

I.) *normal.* Sparingly soluble in boiling water. Almost entirely insoluble in alcohol, or ether. (Hlasiwetz.)

$C_{18}H_8Cu_2O_6 + x\,Aq$

II.) *acid.* Difficultly soluble in boiling water, or alcohol. Easily soluble in ether. (Hlasiwetz.)

$C_{18}H_9CuO_6 + 2\,Aq$

Phloretate of Ethyl. *Vid.* EthylPhloretic Acid.

Phloretate of Lead.

I.) *normal.* Ppt. Partially decomposed when washed with water.

$C_{18}H_8Pb_2O_6 + x\,Aq$

II.) *basic.* Ppt.

$C_{18}H_8Pb_2O_6;\ PbO,\ HO + Aq$

Phloretate of Lime.

I.) *normal.* Soluble in water.

Phloretate of Magnesia.

Phloretate *of dinoxide* **of Mercury.** } Ppts.
Phloretate *of protoxide* **of Mercury.** }

Phloretate of Potash.

I.) *acid.* Efflorescent. Soluble in water, and alcohol. Insoluble in ether. (Hlasiwetz.)

$C_{18}H_9KO_6 + x\,Aq$

Phloretate of Silver. Sparingly soluble in cold water. Easily soluble in acetic acid, and in ammonia-water.

$C_{18}H_9AgO_6$

Phloretate of Soda.

I.) *acid.* Efflorescent. Soluble in water.

$C_{18}H_9NaO_6 + x\,Aq$

Phloretate of Urea. Soluble in water.

$C_{38}H_{24}N_2O_{14} = C_{18}H_9\left(N_2\left\{\begin{matrix} C_2O_2'' \\ H_5 \end{matrix}\right.\right)O_6;\ C_{18}H_{10}O_8$

Phloretate of Zinc.

I.) *normal.* Insoluble in water.

II.) *acid.* Permanent. Very sparingly soluble in water. (Hlasiwetz.)

$C_{18}H_9ZnO_6$

Phloretin. Almost insoluble in cold, very sparingly soluble in boiling water. Soluble in all proportions in boiling, less soluble in cold alcohol, wood-spirit, and concentrated acetic acid. Very sparingly soluble in anhydrous ether. Soluble in concentrated acids, without alteration. Decomposed by dilute nitric acid. (Stass.)

(*Phloretate of Phloro Glucin.*)

$C_{30}H_{14}O_{10} = \left.\begin{matrix} C_{18}H_8O_2'' \\ H\,.\,C_{12}H_5O_4 \end{matrix}\right\} O_4$

Phloretol. Very sparingly soluble in water. Miscible in all proportions with alcohol, and ether. Soluble in concentrated sulphuric acid, with subsequent decomposition. (Hlasiwetz, *Ann. Ch. u. Pharm.*, **102.** 166.)

(*Hydrate of Phloryl. Xylenyl Alcohol. Isomeric with Phenate of Ethyl.*)

$C_{16}H_9O,\ HO$

Phloretylamic Acid. Very sparingly soluble in cold, tolerably soluble in hot water. Soluble in alcohol, and ether. (Hlasiwetz.)

$C_{18}H_{11}NO_4 = N\left\{\begin{matrix} C_{18}H_8O_2'' \\ H_2 \end{matrix}\right. .\,O,\ HO$

Phloridzein. Easily soluble in boiling water. Scarcely at all soluble in alcohol, wood-spirit, or ether. (Stass.)

(*Phlorizeine.*)

$C_{42}H_{30}N_2O_{26} = N_2\left\{\begin{matrix} C_{18}H_8O_2'' \\ C_{12}H_{11}O_{10} \\ C_{12}H_5O_4 \\ H_2 \end{matrix}\right. .\,O_6 + 4\,Aq$

Phloridzein with Ammonia. Very soluble in water.

$C_{42}H_{29}(NH_4)N_2O_{26} + Aq$

Phloridzin. Scarcely at all soluble in cold, soluble in all proportions in boiling water. Soluble in 1000 pts. of cold water. Very easily soluble in alcohol, and wood-spirit. Boiling ether only dissolves traces of it. Soluble in cold, weak acids, even in oxalic acid, but these solutions are decomposed when heated to 80° @ 90°. Soluble in alkaline solutions.

(*Phlorizin. Phloridzic Acid.*)

$C_{42}H_{24}O_{20} + 4\,Aq =$

$C_{12}H_{11}O_{10}\cdot\left.\begin{matrix} C_{18}H_8O_2'' \\ C_{12}H_5O_4 \end{matrix}\right\} O_4 + 4\,Aq$

Phloridzate of Baryta. Ppt.

$C_{42}H_{24}O_{20},\ 2\,BaO$

Phloridzate of Lead.

$O_{42}H_{24}O_{20},\ 6\,PbO$

Phloridzate of Lime. Soluble in water.

$C_{42}H_{24}O_{20},\ 3\,CaO + 3\,Aq$

PhloroGlucin. When anhydrous it is permanent, but the hydrate effloresces in warm air. Readily soluble in water, and alcohol, and still more soluble in ether. From the ethereal solution it crystallizes in the anhydrous state. In presence of carbonate of potash it is insoluble in alcohol or ether. Unacted upon by cold chlorhydric acid. Soluble in nitric acid, with decomposition.

(*Isomeric with Frangulin and Pyrogallic Acid.*)

$C_{12}H_8O_6 + 4\,Aq = \left.\begin{matrix} C_{12}H_5O_4 \\ H \end{matrix}\right\} O_2 + 4\,Aq$

PhloroGlucin with Oxide of Lead. Ppt.
$C_{12}H_6O_6, 4\,PbO$

Phocenic Acid. *Vid.* Valeric Acid.

Phocenin. *Vid.* Valerin; also Delphinin.

Phoenicin. *Vid.* SulphoPhenicic Acid.

Phorone. Insoluble in water. Soluble in alcohol, and with peculiar facility, in ether. It does not combine with acids or alkalies (Laurent); but is soluble in concentrated sulphuric acid, from which the greater part of it is reprecipitated on the addition of water. (Gerhardt & Lies Bodart.)
(*Camphoryl.*)
$C_{36}H_{28}O_4 = \begin{matrix}C_{20}H_{14}O_4{}''\\C_{16}H_{14}{}''\end{matrix}$

Phorylamin.
$C_{18}H_{15}N = N\left\{\begin{matrix}C_{18}H_{13}\\H_2\end{matrix}\right.$

Phosgene, or Phosgene Gas. *Vid.* ChloroCarbonic Acid.

PhosphAcetic Acid. Very soluble in water. (Zeise, *Ann. Ch. et Phys.*, (3.) **6.** 504.)

PhosphAcetate of Baryta. Readily soluble in water. Sparingly soluble in alcohol. (Gm.)

PhosphAcetate of Lead. Insoluble in water. (Zeise, *Ibid.*, pp. 503, 504.)

PhosphAcetate of Lime. Soluble in water; the aqueous solution is liable to undergo decomposition when evaporated.

PhosphAcetate of Silver. Ppt.

PhosphAcetate of Soda. Soluble in water. (Zeise, *Ibid.*, p. 504.)

Phospham. Insoluble in water, alcohol, ether, dilute nitric acid, or aqueous solutions of the caustic alkalies. (Berzelius's *Lehrb.*, **1.** 212.) Unacted upon by dilute chlorhydric, sulphuric, or nitric acids, or by boiling aqueous solutions of the caustic alkalies. (H. Rose.) Insoluble in water, or in fuming nitric acid. (Pauli, *Ann. Ch. u. Pharm.*, **101.** 41.) Decomposed by concentrated alkaline solutions, and by lime and baryta-water.
(*Phosphorstickstoff*, PN_2, of Liebig & Wœhler and H. Rose.)
PN_2H

Phosphamic Acid. Easily soluble in water, and alcohol. The alkaline phosphamates and those of the metal ammoniums are soluble; but the metallic salts are precipitates insoluble in water, and but sparingly soluble in acid liquors.
$\left.\begin{matrix}NH.PO_2\\H\end{matrix}\right\}O_2$

Phosphamate of Ammonia. Soluble in water.

Phosphamate of Baryta. Ppt. Insoluble in ammonia-water.
$NHBaPO_4$

Phosphamate of Cadmium.
$NHCdPO_4 + 2\,Aq$

Phosphamate of Chromium. Ppt. Soluble in ammonia-water.

Phosphamate of Cobalt. Ppt. Soluble in ammonia-water.

Phosphamate *of protoxide* **of Copper.** Ppt. Soluble in ammonia water.

Phosphamate of Ferammonium. Soluble in water.
$NH(NH_3Fe)PO_4$

Phosphamate of Iron. Ppt. Soluble in ammonia-water. Insoluble in acids, being scarcely at all acted upon by concentrated sulphuric acid.
$NHFePO_4 + 2\,Aq$

Phosphamate of Lead. Ppt. Insoluble in ammonia-water.

Phosphamate of Lime. Ppt. Insoluble in ammonia-water.
$NHCaPO_4$

Phosphamate of Magnesia. Ppt. Insoluble in ammonia-water.

Phosphamate of Manganese. Ppt. Insoluble in ammonia-water.

Phosphamate *of protoxide* **of Mercury.** Ppt. Soluble in ammonia-water.

Phosphamate of Nickel. Ppt. Soluble in ammonia-water.
$NHNiPO_4 + 2\,Aq$

Phosphamate of Silver. Ppt. Soluble in ammonia-water.

Phosphamate of Strontia. Ppt. Insoluble in ammonia-water.

Phosphamate of Zinc. Ppt. Soluble in ammonia-water. (H. Schiff, *Ann. Ch. u. Pharm.*, **103.** 168.)

***Mono*Phosphamid** (of Schiff, 1857). Insoluble in all ordinary menstrua; but is partially decomposed when heated with water.
(*Phosphamid* (of Gladstone, 1850). *BiPhosphamid* (of Gerhardt).)
$N\left\{PO_2{}'''\right.$

Insoluble like biphosphamid ($N_2PO_2H_3$). (Gerhardt, *Ann. Ch. et Phys.*, (3.) **18.** 195.)

***Bi*Phosphamid** (of Schiff, 1857). Insoluble in water, but is decomposed by long-continued boiling therewith. Insoluble in alcohol, or oil of turpentine, and in all ordinary menstrua. Difficultly decomposed by boiling concentrated sulphuric acid. (Gladstone.) Insoluble in boiling water, in a boiling dilute solution of caustic potash or of dilute nitric acid. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **18.** 191.)
(*Phosphamid* (of Gerhardt). *BiHydrate of Phosphide of Nitrogen* (of Liebig & Wœhler).)
$N_2\left\{\begin{matrix}PO_2{}'''\\H_3\end{matrix}\right.$

***Tri*Phosphamid.** Insoluble in water. Scarcely at all acted upon by long boiling with water, dilute acids, or an aqueous solution of caustic potash. Slowly decomposed by boiling concentrated nitric or chlorhydric acid, and more readily by aqua-regia. Tolerably readily soluble in concentrated sulphuric acid, or a mixture of concentrated sulphuric and nitric acids, with decomposition. (Schiff, *Ann. Ch. u. Pharm.*, **101.** 302.)
$N_3H_6PO_2 = N_3\left\{\begin{matrix}PO_2{}'''\\H_3\\H_3\end{matrix}\right.$

Phosphoric Acid. Three principal isomeric modifications of phosphoric acid are universally admitted by chemists, viz., *a*(*meta*), *b*(*pyro* or "*para*"), and *c*(*ordinary* or "*di*,") phosphoric acid. There are, moreover, several subvarieties of *meta*phosphoric acid, Fleitmann (*Pogg, Ann.*, 1849, **78.** pp. 239, 362) having enumerated as many as five distinct polymeric modifications of metaphosphoric acid. Besides these, Fleitmann & Henneberg (*Ann. Ch. u. Pharm.*, 1848, **65.** 324), maintain the existence of two other varieties of phosphoric acid intermediate between meta- and pyrophosphoric acids; one [*d*] having the formula $6\,HO, 4\,PO_5$, and the other [*e*] the formula $6\,HO, 5\,PO_5$; but these have not been generally accepted by chemists. Laurent & Gerhardt have suggested that the salts which have been described as belonging to these acids [*d* and *e*] are nothing more than pyrophosphates, intermediate between the normal and acid salts already known. (See *Gmelin's Handbook*, **3.** 96.)
PO_5

a = *meta* (*uni-basic*).

(*Acid of the insoluble alkaline metaphosphates.*)
$H O, a^{I}PO_5$

I.) *Monometaphosphoric acid.* Not isolated. It is formed, in combination with potash, soda, and ammonia, when these bases are heated with phosphoric acid under certain circumstances. These salts are all insoluble. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 362, 360.)

(*First acid of Fleitmann. Acid in several of Maddrell's salts.*)
$2 H O, 2 a^{II}PO_5$

II.) *Dimetaphosphoric acid.* Not isolated. It is formed, when phosphoric acid is heated with the oxides of copper, zinc, or manganese. (Fleitmann, *Pogg.*, *Ann.*, 1849, **78.** pp. 363, 240.) The simple alkaline salts of dimetaphosphoric acid, and some of the double salts which contain an alkaline base, are soluble in water; the others are difficultly soluble, or insoluble in water.

(*Acid of Fleitmann & Henneberg.*)
$3 H O, 3 a^{III}PO_5$

III.) *Trimetaphosphoric Acid.* Formed by heating somewhat strongly, but not melting monopyrophosphate of soda, or by allowing melted hexametaphosphate of soda to cool very slowly. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 304, 306, 316; Fleitmann, *Pogg. Ann.*, 1849, **78.** 363; Graham, see under *trimeta*PHOSPHATE OF SODA.)

Soluble in water, and the solution is tolerably permanent in the cold, but on evaporation the acid is quickly changed to ordinary *c* phosphoric acid. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 241.) With all strong bases, the alkaline earths, and metallic oxides, it forms simple salts, and double soda salts, all of which are soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 309.)

(*Second acid of Fleitmann.*)
$4 H O, 4 a^{IV}PO_5$

IV.) *Tetrametaphosphoric Acid.* Not isolated. It is formed. when phosphoric acid is heated with the oxides of lead, bismuth, and cadmium, or a mixture of equal equivalents of oxide of copper and soda. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 363.) Its alkaline salts are soluble in water, but insoluble in alcohol. Those of the metals and alkaline earths are insoluble in water. (Fleitmann, *loc. cit.*, p. 353, *et seq.*)

(*Ordinary modification. Glacial Phosphoric Acid. Acid of the deliquescent metaphosphate of soda*, of Graham.)
$6 H O, 6 a^{VI}PO_5$

V.) *Hexametaphosphoric Acid.* Formed, when hydrated phosphoric acid is ignited; by the sudden cooling of melted metaphosphate of soda, and when oxide of silver and phosphoric acid are heated together. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 363, 359; Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, pp. 316, 305.) Glacial phosphoric acid is deliquescent when pure; and easily soluble in water, with evolution of heat and transformation to ordinary *c* phosphoric acid. But when contaminated with earthy impurities it is often very slowly and difficultly soluble in water, and not deliquescent; phosphate of magnesia especially, even when in small quantity, tends to destroy its solubility (Ot. Gr.), and if much lime, alumina, or silica be present, the acid is scarcely at all soluble in water. (Berzelius's *Lehrb.*, **1.** 553.) For Gregory's observations on the separation of metaphosphate of magnesia, when solutions of impure glacial phosphoric acid are evaporated, see *Ann. Ch. u. Pharm.*, 1845, **54.** 95.)

The aqueous solution undergoes change when exposed to the air, ordinary *c* phosphoric acid being formed. When the acid is boiled with water, or heated with sulphuric, chlorhydric, acetic, or phosphoric acids, the same change occurs. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 112, 113; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** pp. 131, 132.) Easily soluble in alcohol, and ether.

The hexametaphosphates of the alkalies are soluble in water, but those of the alkaline earths and metallic oxides are, for the most part, precipitates; these precipitates are, however, usually soluble in an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 2.) Many of the precipitates have a remarkable peculiarity of being converted into heavy, oily, viscid masses of the consistence of pitch, on being agitated or heated, the acid probably passing into another modification, though this is a point still undetermined. (See H. Rose, *Pogg. Ann.*, 1849, **76.** p. 2, *et seq.*; Berzelius, *Ibid.*, **19.** 333.)

Another point still undetermined is the question to which modification should be referred the variety of metaphosphoric acid which is obtained by burning phosphorus in oxygen. The experiments of H. Rose (*Pogg. Ann.*, 1849, **76.** pp. 5, 11, *et seq.*), indicating merely that it differs from the acid prepared from hexametaphosphate of soda. This anhydrous acid, obtained by combustion, deliquesces rapidly in the air. It has a very strong affinity for water, in which it dissolves with evolution of heat; but is, nevertheless, only slowly soluble in water.

b = *pyro* [or "*para*"] (*bi-basic*).

$2 H O, bPO_5$ Soluble in water. The concentrated aqueous solution may be preserved without change for a long time at the ordinary temperature; but when heated the acid passes into the ordinary *c* modification.

When the aqueous solution is contaminated with even a trace of sulphuric acid, the greater part of it will change to the ordinary (*c*) acid in the course of 24 hours. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 133.)

The alkaline salts of pyrophosphoric acid are soluble in water, but most of the other salts are precipitates; these precipitates are, however, for the most part, readily soluble in aqueous solutions of the alkaline pyrophosphates,—soluble double salts being formed. (Stromeyer; Schwarzenberg; Persoz; H. Rose, *loc. inf. cit.*) In those solutions of pyrophosphoric acid, where it is saturated or supersaturated with a strong base it may be preserved unchanged; no transformation of *b* into *c* phosphoric acid occurring, either on boiling or long standing. A solution of pyrophosphate of soda may be kept without alteration for years; and when a solution of the acid is evaporated with an excess of alkali it is changed to *c* phosphoric acid only when the dry residue has been completely melted. (H. Rose, *Pogg. Ann.*, 1849, **76.** 20.) In presence of acids, however, the conversion of *b* into *c* phosphoric acid is easy, especially when the solutions are heated; and the change is the more complete in proportion as the acid is stronger. According to Weber, this change is best effected by means of concentrated sulphuric acid. (H. Rose, *Ibid.*, p. 21.)

For Rose's remarks upon the probability of the existence of two modifications of pyrophosphoric acid, see *Pogg. Ann.*, 1849, **76.** 13. For Gregory's, see *Ann. Ch. u. Pharm.*, 1845, **54.** 98, *note.*

c = *ordinary*, or *di* (*terbasic*).

$3HO, cPO_5$ Extremely deliquescent. Soluble in water, and alcohol.

An aqueous solution of sp. gr. at (15°)	Contains (by experiment) per cent of $3HO, PO_5$
1.0333	6
1.0688	12
1.1065	18
1.1463	24
1.2338	36
1.3840	54

From these results Schiff deduces the formula: —

$$D = 1 + 0.005378p + 0.00002886\,p^2 + 0.00000006\,p^3;$$

in which D = the sp. gr. of the solution, and the p the percentage of acid contained in the solution, by means of which Ott has calculated the following table.

Sp. gr. (at 15°)	Per cent of $3HO, PO_5$.	Per cent of anhyd. PO_5.
1.0054	1	0.726
1.0109	2	1.452
1.0164	3	2.178
1.0220	4	2.904
1.0276	5	3.630
1.0333	6	4.356
1.0390	7	5.082
1.0449	8	5.808
1.0508	9	6.534
1.0567	10	7.260
1.0627	11	7.986
1.0688	12	8.712
1.0749	13	9.438
1.0811	14	10.164
1.0874	15	10.890
1.0937	16	11.616
1.1001	17	12.342
1.1065	18	13.068
1.1130	19	13.794
1.1196	20	14.520
1.1262	21	15.246
1.1329	22	15.972
1.1397	23	16.698
1.1465	24	17.424
1.1534	25	18.150
1.1604	26	18.876
1.1674	27	17.602
1.1745	28	20.328
1.1817	29	21.054
1.1889	30	21.780
1.1962	31	22.506
1.2036	32	23.232
1.2111	33	23.958
1.2186	34	24.684
1.2262	35	25.410
1.2338	36	26.136
1.2415	37	26.862
1.2493	38	27.588
1.2572	39	28.314
1.2651	40	29.040
1.2731	41	29.766
1.2812	42	30.492
1.2894	43	31.218
1.2976	44	31.944
1.3059	45	32.670
1.3143	46	33.496
1.3227	47	34.222
1.3313	48	34.948
1.3399	49	35.674
1.3486	50	36.400
1.3573	51	37.126
1.3661	52	37.852
1.3750	53	38.578
1.3840	54	39.304
1.3931	55	40.030
1.4022	56	40.756
1.4114	57	41.482
1.4207	58	42.208
1.4301	59	42.934
1.4395	60	43.660

(H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 192.)

In publishing the following table, Dalton (in his *New System*, Pt. **2.** p. 413) remarks that he "thinks it will be found nearly correct; at all events, it may have its use till a better can be formed."

An aqueous solution of sp. gr.	Contains per cent of "real acid."
1.85	50
1.60	40
1.39	30
1.23	20
1.10	10

Miscible with strong acetic acid. Soluble in 30 pts. of warm creosote. (Reichenbach.)

The *c* phosphates of potash, soda, and lithia are soluble in water, no matter in what proportion the acid may be united with these bases; all the others, excepting some acid salts, are nearly insoluble in water, but all are soluble in an excess of phosphoric acid.

The salts of ordinary *c* phosphoric acid, with the exception of those noted below, are all soluble in dilute nitric acid; less easily soluble in acetic acid, excepting the phosphates of lead, and of sesquioxide of iron, which are insoluble; and also slightly soluble in aqueous solutions of ammoniacal salts, especially of chloride of ammonium, from which solutions they are usually precipitated on the addition of caustic ammonia.

The salts of *c* phosphoric acid which are insoluble in water, are also insoluble in an excess of aqueous solutions of the alkaline *c* phosphates; while, on the other hand, the pyrophosphates are almost all soluble in an excess of a solution of an alkaline pyrophosphate — those of baryta, lime, and silver being the least soluble. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 318.) Very many of the *c* phosphates, which are insoluble in water dissolve in an excess of the aqueous saline solutions, from which they were originally precipitated; from the solutions thus obtained the phosphate is usually precipitated again when heat is applied, but the precipitate disappears again as the mixture cools. (H. Rose, *Pogg Ann.*, 1849, **76.** 23.)

Any insoluble *c* phosphate of a protoxide is completely decomposed by any soluble salt of a sesquioxide, as an alum, for example, either in the cold or at the boiling temperature, an insoluble phosphate of the sesquioxide being formed. (Guignet, *C. R.*, **49.** 454.) All phosphates, excepting the phosphate of binoxide of tin [and of bismuth] are soluble in nitric acid. (Reynoso, *Ann. Ch. et Phys.*, (3.) **34.** 321.) All phosphates are either insoluble, or but very sparingly soluble in alcohol. (Gmelin's *Handbook*, **8.** 265.)

d = *First acid of Fleitmann and Henneberg.*

(SesquiPhosphoric Acid.)
"$6HO, 4PO_5$."

Not isolated. Is said to exist in a soda-salt obtained by fusing together various mixtures of the soda-salts of the *a*, *b*, and *c* modifications of phosphoric acid. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 324, 332; compare Laurent & Gerhardt, *Gmelin's Handbook*, **3.** 96.)

e = Second acid of Fleitmann and Henneberg. Not isolated. Is said to exist in a soda-salt obtained by fusing together certain proportions of pyrophosphate of soda, and hexametaphosphate of soda. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 324, 333; compare Laurent & Gerhardt, *Gmelin's Handbook*, **3.** 96.)
"$6\,H\,O, 5\,PO_5$."

PHOSPHATE OF ACONITIN. Soluble in water.

PHOSPHATE OF AGROSTEMMIN. Ppt.

*Meta*PHOSPHATE OF ALUMINA.

I.) $Al_2\,O_3, 3\,aPO_5$ Insoluble in water, and concentrated acids. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 59.)

*Pyro*PHOSPHATE OF ALUMINA. Soluble in mineral acids, and in an aqueous solution of pyrophosphate of soda. Insoluble in acetic acid. (Wittstein.) Soluble in sulphurous acid, from which it is reprecipitated on boiling. Soluble in aqueous solutions of caustic ammonia and potash. A basic salt, insoluble in ammonia-water, is formed when the chlorhydric acid solution is treated with ammonia. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 148.) Soluble in aqueous solutions of pyrophosphate of soda, and of alum. (H. Rose, *Pogg. Ann.*, 1849, **76.** 19.)
$2\,(Al_2\,O_3{}^{\prime\prime\prime}), 3\,bPO_5 + 10\,Aq$

PHOSPHATE OF ALUMINA.
(DiPhosphate of Alumina. SesquiPhosphate of Alumina. Ordinary precipitated Phosphate.)

I.) $Al_2\,O_3, cPO_5 + 6\,@\,9\,Aq$ Insoluble in water, or in an aqueous solution of chloride of ammonium. Soluble in acids, even in acetic acid. (Wittstein.) Soluble in cold, insoluble in warm acetic acid. (Ot. Gr.) Soluble in phosphoric, and in weak chlorhydric, and nitric acids. Soluble in an aqueous solution of caustic potash, from which it is reprecipitated by chloride of ammonium. (Berzelius's *Lehrb.*) Vauquelin has stated that it is decomposed by a solution of carbonate of potash, with separation of pure alumina; but this decomposition is only partial, a basic phosphate, apparently No. III., being formed. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 492.) Slightly soluble in an aqueous solution of alum. On heating the solution thus obtained an abundant precipitate is formed which disappears again for the most part on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 26.) It is not precipitated by ammonia-water from solutions which contain citrate of soda. (Spiller.)

II.) *acid.* Deliquescent. (Fourcroy.)

III.) *basic.* Insoluble in water. (Rammelsberg, *Pogg. Ann.*, **64.** 409.)
$4\,Al_2\,O_3, 3\,cPO + 15\,Aq\ \&\ 18\,Aq$

PHOSPHATE OF ALUMINA & LEAD.
$6\,(Al_2\,O_3, 3\,H\,O); 3\,Pb\,O, PO_5$

PHOSPHATE OF ALUMINA & OF LITHIA. Insoluble in water. Easily soluble in acids. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 270.)
$2\,(3\,Li\,O, P\,O_5); 6\,Al_2\,O_3, P\,O_5 + 30\,Aq$

PHOSPHATE OF ALUMINA & OF MAGNESIA.
(Lazulite.) Unacted upon by acids, until it has been ignited.

*Pyro*PHOSPHATE OF ALUMINA & OF SODA. Very soluble in water. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 322.)

*Meta*PHOSPHATE OF AMMONIA.

I.) *Mono*METAPHOSPHATE. Completely insoluble in water, and resembles the potash and soda-salts in its other physical properties. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 252.)

II.) *Di*METAPHOSPHATE. Soluble in 1.15 pts. of water, either hot or cold. Its solubility in dilute spirit is much more considerable than that of the potash or soda salt. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 251.)
$2\,N\,H_4\,O, 2\,a^{\prime\prime}PO_5$

III.) *Hexa*METAPHOSPHATE? Known only in aqueous solution. When the aqueous solution is allowed to evaporate spontaneously, the salt is decomposed. (Graham; compare Wach, *Schweigger's Journ. für Ch. u. Phys.*, 1830, **59.** 302.)

PYROPHOSPHATE OF AMMONIA.

I.) *normal.* The aqueous solution is perfectly stable at the ordinary temperature, and when allowed to evaporate spontaneously appears to crystallize, but in the act of becoming solid it passes into the ordinary *c* monophosphate ($N\,H_4\,O, 2\,H\,O, cPO_5$). (Graham, *Elements.*) Easily soluble in water, the solution losing ammonia when boiled. Alcohol precipitates it from the aqueous solution. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 141.)
$2\,N\,H_4\,O, bPO_5$

II.) *acid.* Easily soluble in water. Only sparingly soluble, or insoluble in alcohol. Alcohol precipitates it as a syrupy, aqueous solution from an acetic acid solution of the normal *b* salt (No. I.) (Schwarzenberg, *loc. cit.*, p. 142.)
$N\,H_4\,O, H\,O, bPO_5$

PHOSPHATE OF AMMONIA.
(Neutral Phosphate of Ammonia.)

I.) *di.* The crystals undergo decomposition when exposed to the air (Mitscherlich, *loc. inf. cit.*); effloresce superficially, with loss of ammonia. (H. Rose.) Very soluble in water. (Berzelius, *Gilbert's Ann. Phys.*, 1816, **53.** 415.) More soluble in water than the mono-salt. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 383.) Soluble in 4 pts. of cold, and in less hot water; when heated, the solution loses ammonia. Insoluble in alcohol.
$2\,N\,H_4\,O, H\,O, cPO_5$

100 pts. of water at 15.5° dissolve 50 pts. of it.
" 15.5° " 25 "
" 100° " more than 25 "
(Ure's *Dict.*)

II.) *mono.* Permanent. Very easily soluble in water. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 373.) Less soluble in water than the diphosphate. (*Ib.*, p. 383.) Soluble in 5 pts. of cold water; more easily soluble in hot water. (Mitscherlich[?].)
$N\,H_4\,O, 2\,H\,O, cPO_5$

III.) *tris.* Decomposes at once when exposed to the air. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 383.) Less soluble in water than the di-salt. The aqueous solution is decomposed by evaporation. (Berzelius, *Gilbert's Ann. Phys.*, 1816, **53.** 415.) Insoluble in aqueous alkaline solutions. (Berzelius's *Lehrb.*, **2.** 334.)
$3\,N\,H_4\,O, cPO_5$

*DiMeta*PHOSPHATE OF AMMONIA & OF CADMIUM. Efflorescent. (Fleitmann, *Pogg. Ann.*, **78.** 347.)
$N\,H_4\,O, Cd\,O, 2\,a^{\prime\prime}PO_5 + 3\,Aq$

*Meta*PHOSPHATE OF AMMONIA & OF COBALT. Extremely soluble in water, and in ammonia-water. (Persoz, *J. pr. Ch.*, 1834, **3.** 215; and *Ann. Ch. et Phys.*, (3.) **20.** 316.)

*DiMeta*PHOSPHATE OF AMMONIA & OF COPPER. The 2 Aq salt is
$N\,H_4\,O, Cu\,O, 2\,a^{\prime\prime}PO_5 + 2\,Aq\ \&\ 4\,Aq$

permanent, but the 4 Aq salt loses part of its water when exposed to the air. Very difficultly soluble in water. Insoluble in alcohol. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 345.)

PHOSPHATE OF AMMONIA & *of protoxide* OF IRON.
$NH_4O, 2FeO, cPO_5 + 2Aq$
Permanent. Insoluble in water, even when this is hot, or in alcohol. While yet moist it dissolves very easily in dilute acids, but after having become dry, tolerably concentrated acids are required for its solution, and these in much larger quantity than is the case with the analogous salts of magnesia and of manganese. Decomposed by ammonia-water and solutions of the fixed caustic alkalies. (Otto, *J. pr. Ch.*, 1834, **2.** 412.)

PHOSPHATE OF AMMONIA & *of sesquioxide* OF IRON. Soluble in ammonia-water. (Dœbereiner.)

*DiMeta*PHOSPHATE OF AMMONIA & OF LEAD.
$NH_4O, PbO, 2a''PO_5$
Very difficultly soluble in water. Only difficultly attacked by acids. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 344.)

Persoz, also, (*J. pr. Ch.*, 1834, **3.** 216) mentions an insoluble compound.

*DiMeta*PHOSPHATE QF AMMONIA & OF LIME.
$NH_4O, CaO, 2a''PO_5 + 2Aq$
Very difficultly soluble in water. Towards acids it behaves like the lime-salt. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 344.)

*HexaMeta*PHOSPHATE OF AMMONIA & OF LIME.
$NH_4O, 5CaO, 6a^{vi}PO_5$
Insoluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 362.)

PHOSPHATE OF AMMONIA & OF LITHIA.
$NH_4O, 2LiO, cPO_5$
Difficultly soluble in water. (Berzelius.)

*DiMeta*PHOSPHATE OF AMMONIA & OF MAGNESIA.
$NH_4O, MgO, 2a''PO_5 + 6Aq$
Efflorescent. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 347.)

*HexaMeta*PHOSPHATE OF AMMONIA & OF MAGNESIA?
$4MgO, NH_4O, 4PO_5 + 17Aq$
Soluble to a considerable extent in cold water, from which it is precipitated on the addition of alcohol. When boiled in water it appears to dissolve but slightly, and when the cold aqueous solution is heated nearly to boiling, a precipitate forms in it, which slowly dissolves again as the solution cools. It dissolves readily in chlorhydric, nitric, and probably other acids. Somewhat soluble in an aqueous solution of sulphate of magnesia, from which it is precipitated on the addition of alcohol; also soluble, though less abundantly in solutions of the nitrate, chloride, and acetate of magnesium. Less soluble in a solution of hexametaphosphate of magnesia. (Wach, *Schweigger's Journ. für Ch. u. Phys.*, 1830, **59.** pp. 303, 302, 308.)

PHOSPHATE OF AMMONIA & OF MAGNESIA.

I.) $2MgO, NH_4O, cPO_5 + 12Aq$
The anhydrous salt is soluble in 15293 pts. of water at the ordinary temperature; and is much less soluble in water containing ammonia, from 42780 to 45880 pts. (in the mean 44330 pts.) of such a solution having been required to dissolve 1 pt. of the anhydrous salt at 14°. In a more recent experiment [in reply to Weber], Fresenius found that 44600 pts. of water containing ammonia dissolved 1 pt. of the anhydrous phosphate. It is a little more soluble in water which contains chloride of ammonium than in pure water, only 7548 pts. of a solution containing 1 pt. of NH_4Cl to 5 pts. of water being required to dissolve it; but of a solution of 1 pt. of NH_4Cl in 7 pts. of water containing ammonia 15627 pts. were required. (Fresenius, *Quant.*, pp. 130, 756.)

When recently precipitated it is soluble in a hot aqueous solution of chloride of ammonium, and is not reprecipitated therefrom on the addition of an excess of ammonia. Less easily soluble in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 334.) Insoluble in cold aqueous solutions of chloride of ammonium or other ammoniacal salts. (H. Rose, *Tr.*) No more soluble in solutions of the alkaline phosphates than in water. Easily soluble in acids, even acetic and carbonic acids (Pfaff), with partial decomposition.

Completely insoluble in water which contains phosphate of ammonia, or phosphate of ammonia and soda, in solution. But its solubility in water is not lessened by any other salts besides the phosphates. (Berzelius, *Lehrb.*, **3.** 441.) When in presence of iron or alumina it is soluble to a considerable extent in tartaric acid.

A mixture of 3 pts. water and 1 pt. ammonia-water of 0.96 sp. gr., is best suited for washing it; a mixture of 4 pts. of water with 1 pt. of ammonia-water, as well as strong ammonia-water, dissolves magnesia from it. (Kremers, from *Pogg. Ann.*, in *J. pr. Ch.*, 1852, **55.** 190.) In a series of experiments made for the purpose of testing the above statement of Kremers, Ebermayer (*J. pr. Ch.*, 1853, **60.** 41), found that 1 pt. of the anhydrous salt is soluble in 13497 pts. of water at 23°; in 31048 pts. of a mixture of 4 pts. of water and 1 pt. ammonia-water, of 0.961 sp. gr., at 21.25°; in 36764 pts. of a mixture of 3 pts. of water and 1 pt of ammonia-water, at 20.6°; in 43089 pts. of a mixture of equal pts. of water and ammonia-water; in 45206 pts. of a mixture of 1 pt. of water and 2 pts. of ammonia-water, at 22.5°; in 52412 pts. of a mixture of 1 pt. of water and 3 pts. of ammonia-water, at 22.5°; and in 60883 pts. of pure ammonia-water, at 21.25°.

II.) $MgO, NH_4O, HO, cPO_5 + 8Aq$ (Graham.)

*DiMeta*PHOSPHATE OF AMMONIA & OF MANGANESE.
$NH_4O, MnO, 2a''PO_5 + 6Aq$
Efflorescent. (Fleitmann, *Pogg. Ann.*, **78.** 347.)

PHOSPHATE OF AMMONIA & OF MANGANESE.
$NH_4O, 2MnO, cPO_5 + 12Aq$
Insoluble in boiling water, or alcohol. Soluble in dilute acids. (Otto.)

*Pyro*PHOSPHATE OF AMMONIA, OF MANGANESE, & OF SODA.
$NH_4O, MnO, bPO_5; NaO, MnO, bPO_5 + 6Aq$
Permanent. Insoluble in water or alcohol. Readily soluble in acids, even when these are very dilute. (Otto, *J. pr. Ch.*, 1834, **2.** 418.)

*Meta*PHOSPHATE OF AMMONIA & OF MERCURY (HgO). Soluble in water, or at least, in ammonia-water. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.)

*Meta*PHOSPHATE OF AMMONIA & OF NICKEL. Insoluble in water. Soluble in ammonia-water, from which it is redeposited when the ammonia is allowed to exhale. (Persoz, *J. pr. Ch.*, 1834, **3.** 215.) [Compare the remarks of Persoz, in *Ann. Ch. et Phys.*, (3.) **20.** 316.]

PHOSPHATE OF AMMONIA & OF NICKEL. Insoluble in water or alcohol. (Compare Tupputi, *Ann. de Chim.*, 1811, **78.** 169.)

*DiMeta*Phosphate of Ammonia & of Potash.

a.) $NH_4O, 3KO, 4a''PO_5 + 4Aq$ Difficultly soluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 341.)

b.) $5NH_4O, 2KO, 7a''PO_5$ Somewhat more soluble in water than the preceding salt. (Fleitmann, *loc. cit.*)

*Pyro*Phosphate of Ammonia & of Potash. $2KO, bPO_5; NH_4O, HO, bPO_5 + Aq$ Deliquescent. Soluble in water; the solution losing ammonia when boiled. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 137.)

*DiMeta*Phosphate of Ammonia & of Soda. $NH_4O, NaO, 2a''PO_5$ More soluble in water than the soda salt, but somewhat less soluble than the ammonia salt. Less soluble in alcohol than in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 340.)

*HexaMeta*Phosphate of Ammonia & of Soda. (*Of varying composition.*) Soluble in water, from which it is precipitated on the addition of spirit. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 361.)

*Pyro*Phosphate of Ammonia & of Soda. $NH_4O, NaO, bPO_5 + 5Aq$ Readily soluble in water, but ammonia is evolved when the solution is heated. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 142.)

Phosphate of Ammonia & of Soda. (*Microcosmic Salt. Phosphorsalt.*) $NH_4O, NaO, HO, cPO_5 + 8Aq$ Efflorescent. Readily soluble in water. The aqueous solution gradually evolves ammonia, especially if it be heated. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 400.) Soluble in 6 pts. of cold, and in 1 pt. of boiling water. Insoluble in alcohol.

Soluble in 6 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76.)

Phosphate of Ammonia & of Uranium. $NH_4O, 2Ur_2O_3, cPO_5$ Insoluble in water, or in an aqueous solution of acetate of ammonia. Completely insoluble in acetic acid. (Knop.)

*DiMeta*Phosphate of Ammonia & of Zinc. $NH_4O, ZnO, 2a''PO + 6Aq$ Efflorescent. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 347.)

*Pyro*Phosphate of Ammonia & of Zinc. *Vid.* *b*Phosphate of Zinc & of Zincammonium.

Phosphate of Ammonia & of Zinc. $NH_4O, 2ZnO, cPO_5 + 2Aq$ Insoluble in water. Soluble in acids, and in aqueous solutions of caustic potash, soda, and ammonia. (Bette.)

Phosphate of AmmonioRhodium. Soluble in water. (Claus, *Beiträge*, p. 90.)

Phosphate of AmmoniumChlorPlatin(*ous*)ammonium. (*Phosphate of Gros's Base.*) Much less soluble in water than the nitrate. (Gros, *Ann. der Pharm.*, 1838, **27.** 256.)

Phosphate of AmmoniumChlorPlatin(*ous*)ammonium & of AmmoniumOxyPlatin(*ous*)ammonium. (*Raewsky's Phosphate. Sesquichlorhydrophosphate de diplatinamine* (of Gerhardt).)

$$H_{13}ClPt_2N_4PO_9 = \left(N\left\{\begin{matrix}H_2\\ NH_4\\ PtCl\end{matrix}\right. .O,\ N\left\{\begin{matrix}H_2\\ PtO\\ NH_4\end{matrix}\right. .O, HO\right)cPO$$

Nearly insoluble in cold, slightly soluble in hot water. (Raewsky.)

Phosphate of Amyl. *Vid.* AmylPhosphoric Acid.

*Meta*Phosphate of Anilin. $N\left\{\begin{matrix}C_{12}H_5\\ H_2.H\end{matrix}\right. .O, aPO_5$ Soluble in water, the solution undergoing decomposition when boiled. Entirely insoluble in alcohol, or ether. (Nicholson.)

*Pyro*Phosphate of Anilin. $2N\left\{\begin{matrix}C_{12}H_5\\ H_2.H\end{matrix}\right. .O, bPO_5; 2HO, bPO_5$ Soluble in water. Entirely insoluble in alcohol or ether. (Nicholson.)

Phosphate of Anilin.

I.) *di.* Very soluble in water, and alcohol. $2N\left\{\begin{matrix}C_{12}H_5\\ H_2.H\end{matrix}\right. .O, HO, cPO_5 + 2Aq$ (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 155.) Readily soluble in water, and ether; less soluble in alcohol. Sparingly soluble in cold alcohol, but so abundantly soluble in hot alcohol that the solution solidifies on cooling. (Nicholson.)

II.) *mono.* Readily soluble, with partial decomposition, in water. $N\left\{\begin{matrix}C_{12}H_5\\ H_2.H\end{matrix}\right. .O, 2HO, cPO_5 + Aq$ Readily soluble, without decomposition, in alcohol, and ether. (Nicholson.)

*Pyro*Phosphate of Antimony. On boiling oxide of antimony with an aqueous solution of monopyrophosphate of soda a liquid is obtained which contains in solution much oxide of antimony; but on evaporating to dryness and adding water, most of the oxide of antimony remains undissolved. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 160.)

Phosphate *of teroxide* of Antimony.

I.) $2SbO_3, PO_5$ Insoluble in cold, slowly decomposed by boiling water. (Brandes.)

II.) $2SbO_3, 3cPO_5 + 2Aq$ Decomposed by cold water. (Brandes.)

III.) $4SbO_3, PO_5$ Insoluble in boiling water. (Brandes.)

Phosphate of AzoNaphthylamin. Sparingly soluble in water, and alcohol. (Zinin.)

*Meta*Phosphate of Baryta.

I.) *Monometaphosphate?* (*Anhydrous.*) BaO, aPO_5 Insoluble in water, and dilute acids. Decomposed by warm concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 61.) Insoluble in acids. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 313.) Completely insoluble in water. Scarcely at all attacked by acids. Not decomposed when digested with carbonate of soda. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 255.) Not decomposed by digestion in solutions of the alkaline carbonates. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 352.)

II.) *Dimetaphosphate.* $2BaO, 2a''PO_5 + 4Aq$ Very difficultly soluble in water. Somewhat less soluble in water than the trimetaphosphate. Scarcely attacked by boiling acids, even by concentrated nitric, or chlorhydric acid. Easily decomposed by concentrated sulphuric acid. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 254.)

III.) *Trimetaphosphate.* $3BaO, 3a'''PO_5 \& + 2Aq \& 6Aq$ Somewhat soluble in water. When heated to redness, it melts, and is then insoluble in acids. (Fleitmann &

Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 313, 314.) See also above, under No. II.

IV.) *Hexametaphosphate?* Insoluble in water. Soluble in an aqueous solution of metaphosphate of soda. Like the metaphosphates in general, it is precipitated with considerable difficulty from very dilute solutions, although when once precipitated it is like them, highly insoluble. It may be boiled in water for two hours without sensible change, but it then begins to dissolve, and the solution proceeds at an accelerated rate, till eventually the whole disappears, having been changed to a soluble *c* phosphate. After having been ignited it is difficultly soluble in nitric acid. (Graham, *Phil. Trans.*, 1833, **123.** pp. 278, 279.) Completely soluble in an aqueous solution of hexametaphosphate of soda. The salt obtained from the acid prepared by burning phosphorus in oxygen is exceedingly difficultly soluble in an excess of this acid. (H. Rose, *Pogg. Ann.*, 1849, **76.** 3; compare also *Ibid.*, pp. 5, 6.) Insoluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.)

*Pyro*PHOSPHATE OF BARYTA. Ppt. Somewhat soluble in water. Insoluble in acetic acid, or in an aqueous solution of pyrophosphate of soda. Soluble in nitric, chlorhydric, and sulphurous acids, and sparingly in pyrophosphoric acid. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 143.) Insoluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.) Insoluble, or as good as insoluble, in an aqueous solution of pyrophosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 16.) Insoluble in an aqueous solution of pyrophosphate of soda, or rather, only very slightly soluble therein when recently precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also, in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

$2\,Ba\,O, b PO_5 + Aq$

PHOSPHATE OF BARYTA.

I.) *ordinary, di.* Permanent. Very sparingly soluble in water.

$2\,Ba\,O, H\,O, c PO_5$

Soluble in 20570 pts. of water at 18.75° @ 22.5°. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1833, **67.** pp. 44, 40.) The solubility of bibasic phosphate of baryta is $\frac{1}{10000}$. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 346.) Soluble in a boiling aqueous solution of chloride of ammonium, with evolution of ammonia. (Fuchs; Demarçay, *Ann. der Pharm.*, 1836, **11.** 251.) Soluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 315.) When recently precipitated it is soluble in a cold aqueous solution of chloride of ammonium, and in the solution thus obtained an excess of ammonia produces no precipitate. Less soluble in a solution of nitrate of ammonia than in a solution of chloride of ammonium. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 334; compare p. 99.) Easily soluble in aqueous solutions of chloride of ammonium, nitrate of ammonia, and succinate of ammonia. (H. Rose, Wittstein.) Only slightly soluble in pure water, but is abundantly soluble in an aqueous solution of chloride of ammonium. Also more soluble in aqueous solutions of the chlorides of barium and sodium than in water, 1 pt. of it dissolving in 4362 pts. of a solution containing 1.2% of Na Cl, and 0.8% of Ba Cl. (Ludwig.) Soluble in an aqueous solution of normal citrate of soda. (Spiller.) It is partially decomposed when boiled with an aqueous solution of carbonate of potash or of carbonate of soda. (Dulong, *Ann. de Chim.*, **82.** 279.) Insoluble in an aqueous solution of phosphate of soda or of chloride of barium. (H. Rose, *Pogg. Ann.*, 1849, **76.** 23.)

When one equivalent of $2\,Ba\,O, H\,O, P\,O_5$ is boiled with 1 equivalent of $K\,O, 2\,C\,O_2$ in aqueous solution $\frac{46{\cdot}82}{100}$ of it may be decomposed; when boiled with an equivalent of $Na\,O, 2\,C\,O_2$ $\frac{25{\cdot}44}{100}$ of it may be decomposed. While, on the other hand, when an equivalent of $Ba\,O, 2\,C\,O_2$ is boiled with one of $2\,K\,O, H\,O, P\,O_5$ $\frac{27{\cdot}77}{100}$ of it may be decomposed, and when boiled with an equivalent of $2\,Na\,O, H\,O, P\,O_5$ $\frac{50}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 348.) When an equivalent of $2 Ba\,O, H\,O, P\,O_5$ is boiled with an equivalent of $K\,O, S\,O_3$, in aqueous solution, $\frac{35}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 335.)

Soluble in 367 @ 403 pts. of acetic acid, of 1.032 sp. gr., at 22.5°. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1833, **67.** 40.) Readily soluble in dilute phosphoric, chlorhydric, and nitric acids with formation of the soluble mono (No. II.) salt. It should be observed, that, speaking in general terms, up to a certain limit, this solution occurs more readily in proportion as the acids are more dilute, for, as a rule, the barium salts are precipitated from their aqueous solutions on the addition of free acid.

Much more soluble in dilute than in concentrated nitric acid at the ordinary temperature. In the experiments tabulated below an excess of the phosphate was digested during 24 hours with nitric acid of the indicated strengths.

1 pt. of phosphate of baryta dissolves at 18.75° @ 22.5° in	of a mixture of 1 pt. of nitric acid of 1.275 sp. gr. at 21.25° and pts. of water.	100 pts. of nitric acid of 1.275 sp. gr., mixed with the amounts of water given in column 2, dissolve pts. of phosphate of baryta.
1563 pts.	0	0.062
318	0.792	0.56
155	1.584	1.67
107	2.375	3.16
69	3.168	6.03
57	3.960	8.74
45	4.752	12.88
52	7.	15.53
48	8.	18.68
30	9.	33.02
22	10.	49.91
45	11.	26.78
66	17.	27.30
63	23.	38.03
74	29.	39.16

From these figures it appears that the solvent power of the nitric acid increases with its dilution up to a certain point, and then decreases as the dilution is increased, though these changes are not regular. The maximum solvent power of the nitric acid of 1.275 sp. gr. occurs when it is diluted with 10 pts. of water, or that of the most concentrated nitric acid, when it is diluted with about 29 pts. of water. In attempting to reconcile the irregularity in experiments 13 and 14, by repeating these, it was inexplicably made greater, as follows: —

1 pt. of phosphate of baryta dissolves at 18.75° @ 22.5° in	of a mixture of 1 pt. of nitric acid of 1.275 sp. gr. at 21.25° and pts. of water.	100 pts. of nitric acid of 1.275 sp. gr., mixed with the amounts of water given in column 2, dissolve pts. of phosphate of baryta.
28 pts.	17	64.39
65	23	36.85

In order to ascertain whether or no these irregularities might be due to differences of temperature the following series of experiments was made at the constant temperature of 15.63° : —

1 pt. of phosphate of baryta dissolves at 15.63° in	of a mixture of 1 pt. of nitric acid of 1 275 sp. gr. at 21.25° and pts. of water.	100 pts. of nitric acid of 1.275 sp. gr., mixed with the amounts of water given in col. 2, dissolve pts. of phosphate of baryta.
392 pts.	1	0.51
94.5	4	5.29
43	7	18.71
27	10	40.19
34	13	41.49
26.5	16	64.19
61	19	32.63

On attempting to reconcile the discrepancies between Nos. 5 and 6 the following discordant results were obtained. (At the temperature of 16.87°.)

24	13	57.45
48	16	35.83

A series of experiments with more dilute acids than the foregoing gave the following results. (Temperature 16.25° @ 17.5°.)

1 pt. of phosphate of baryta dissolves at 16.25° @17.5° in	of a mixture of 1 pt. of nitric acid of 1.275 sp. gr. at 21.25° and pts of water.	100 pts. of nitric acid of 1.275 sp. gr., mixed with the amounts of water given in col. 2, dissolve pts. of phosphate of baryta.
27 pts.	19	74.22
32	29	93.49
45	39	89.76
48	49	104.70
68	79	117.37
72	99	139.73

and (temperature = 11.25°)

571	500 *	87.69
817	1000 *	123.00
8595	10000 *	116.41

The solvent power of the acid is consequently decreased very much by strong dilution; but in the last experiment the 10000 times diluted acid still dissolves more than twice as much of the phosphate as pure water, and the 1000 times diluted acid almost twice as much as the standard acid of 1.275 sp. gr.

Bischof confesses himself unable to explain the great discrepancies which his results exhibit; for his discussion of this question, see p. 47 of his memoir. By direct experiment he found that, while 1 pt. of the phosphate dissolved in 32 pts. of dilute acid, with which it had been violently shaken, the same quantity was dissolved in 31 pts. of similar acid, in which it had been allowed to lie quietly, and from which it was decanted, without disturbing the undissolved phosphate. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1833, **67.** pp. 41 – 50.) In citing the first table of Bischof, Gmelin (*Handbook*, **3.** 144) remarks: "The solution is doubtless effected by the conversion of the diphosphate of baryta into nitrate and soluble monophosphate of baryta. The more concentrated the solution the less easily is the nitrate of baryta taken up. A certain degree of dilution is therefore necessary; but when it is too great, the decomposing influence of the nitric acid is probably interfered with." In confirmation of which compare Bischof's first two experiments, p. 41 of his memoir.

II.) *mono.* Permanent. Decomposed by water, $BaO, 2HO, cPO_5$ especially on boiling, with deposition of the disalt and solution of free phosporic acid and a little phosphate of baryta. Soluble in phosphoric acid and in other acids. (Berzelius, *Gilbert's Ann. Phys.*, 1816, **53.** pp. 398, 399.) Soluble in water. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 360.)

III.) *tri.* Very slightly soluble, or insoluble, $3BaO, cPO_5$ in water. Easily soluble in acids.

IV.) *Compound of Nos. I. and III.* Ppt. Decomposed by water. $2BaO, HO, PO_5; 3BaO, PO_5$ Insoluble in alcohol. (Berzelius, *Gilbert's Ann. Phys.*, 1816, **53.** 400; also in his *Lehrb.*, **3.** 366.)

V.) *Salt of Fleitmann & Henneberg's* 1*st acid.* "$6BaO, 4PO_5 + x Aq.$" Insoluble precipitate. On heating the salt more strongly than is necessary to expel its water it becomes insoluble in acids. (F. & H., *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 331, 332, 329.)

*TriMeta*Phosphate of Baryta & of Soda. $2BaO, NaO, 3a'''PO_5 + 8Aq \& 3Aq$ Much more soluble in water than the simple baryta-salt. When melted it is easily soluble in acids, but if only gently ignited, and not melted, it is insoluble in acids. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 314.)

*Pyro*Phosphate of Baryta & of Soda. $6(2BaO, bPO_5); 2NaO, bPO_5 + 6Aq$ Completely insoluble in an aqueous solution of pyrophosphate of soda, but not insoluble in water or ammonia-water. Easily soluble in nitric and chlorhydric acids. Insoluble in alcohol. (Baer, *Pogg. Ann.*, 1848, **75.** pp. 164, 165.)

Phosphate of Bebirin? Ppt. Easily soluble in chlorhydric acid. (v. Planta, *Phil. Mag.*, 1851, (4.) **1.** 116.)

Phosphate of Benzidin. Almost insoluble in boiling water, or alcohol.

*TetraMeta*Phosphate of Bismuth. Insoluble in water. Easily decomposed by an aqueous solution of sulphide of sodium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 358, 363.)

*HexaMeta*Phosphate of Bismuth. Ppt. Insoluble in water acidulated with nitric acid. Soluble in an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 5.) Insoluble in ammonia-water. (Persoz, *J. pr. Ch.*, 1843, **3.** 215.)

*Pyro*Phosphate of Bismuth. Ppt. Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte*

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* Or, starting with the most concentrated nitric acid, 1 pt. of it is diluted with 1353 pts. of water in the first experiment, with 2704 pts. in the second, and with 27029 pts. in the third.

Anz., 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Ppt. Insoluble in water acidulated with nitric acid. Soluble in an aqueous solution of pyrophosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 20.) A boiling aqueous solution of monopyrophosphate of soda dissolves no inconsiderable quantity of oxide of bismuth. (Schwarzenberg, *Ann. Ch. u. Phys.*, 1848, **65.** 160.)

PHOSPHATE OF BISMUTH.

I.) $Bi\,O_3''', cPO_5 + 3\,Aq$ Insoluble in water or in dilute nitric acid. (Thomson's *System of Chem.*, London, 1831, **2.** 684.) Completely insoluble in water or in hot nitric acid, unless this be present in large excess. Sensibly soluble in aqueous solutions of the ammoniacal salts. (Chancel.)

Phosphate of bismuth is only difficultly precipitated from solutions which contain a salt of sesquioxide of iron; but from solutions containing a salt of protoxide of iron, it is easily precipitated. (Chancel, *C. R.*, 1860, **51.** 882.) When solutions of phosphate of soda and nitrate of bismuth (in dilute nitric acid) are mixed in presence of nitrate of sesquioxide of iron, nitrate of alumina, nitrate of sesquioxide of chromium, or nitrate of sesquioxide of uranium, phosphate of bismuth is not precipitated, or is only partially precipitated. Precipitated phosphate of bismuth may even be redissolved when digested with a large quantity of nitrate of uranium, and but little of this is needed to prevent the precipitation of the phosphate. On the other hand, solutions of the nitrates of ammonia, potash, baryta, strontia, lime, and magnesia do not appear to exercise any solvent action upon the phosphate. (McCurdy, *Am. J. Sci.*, (2.) **31.** 282.) More easily soluble in chlorhydric than in nitric acid. (H. Rose, *Tr.*) Insoluble in solutions of bismuth salts. (H. Rose, *Pogg. Ann.*, 1849, **76.** 26.)

II.) There are two salts; one permanent and soluble, the other insoluble in water. (Wenzel.)

Phosphate of bismuth is readily soluble in an aqueous solution of chloride of ammonium, but insoluble in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 98.)

PHOSPHATE OF BRUCIN.

I.) $2\,(N_2 \left\{ C_{46}\,H_{26}\,O_8^{vi}.\,H\,O\right.), H\,O, P\,O_5 + Aq$ Efflorescent. Tolerably soluble in cold, and soluble in all proportions in hot water. (Anderson, *J. Ch. Soc.*, **1.** 58.)

II.) *acid.* Efflorescent. Very soluble in water.

PHOSPHATE OF BRUCIN & OF SODA.

$N_2 \left\{ C_{46}\,H_{26}\,O_8^{vi}.\,H\,O, Na\,O, H\,O, PO_5 + Aq \right.$

PHOSPHATE OF CACODYL.

*Meta*PHOSPHATE OF CADMIUM. Very soluble in ammonia-water. (Persoz, *J. pr. Ch.*, 1834, **2.** 215.)

*TetraMeta*PHOSPHATE OF CADMIUM. Insoluble in water. Easily decomposed by an aqueous solution of sulphide of sodium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 358, 363.)

*Pyro*PHOSPHATE OF CADMIUM. $2\,Cd\,O, bPO_5 + 2\,Aq$ Soluble in ammonia-water, in acids, and in an aqueous solution of pyrophosphate of soda. Soluble in sulphurous acid, from which it is precipitated when the solution is boiled. Insoluble in a solution of caustic potash. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 153.) Soluble in an aqueous solution of pyrophosphate of soda; but on heating this solution a precipitate forms and does not disappear again on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 19.)

PHOSPHATE OF CADMIUM. $3\,Cd\,O, cPO_5$ Insoluble in water.

Soluble in a cold aqueous solution of chloride of ammonium; less completely soluble in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 99, 334.) Easily soluble in aqueous solutions of the salts of cadmium; on heating the solution thus obtained a precipitate is formed, which disappears again on cooling. (H. Rose, *Pogg. Ann.*, **76.** 25.) Readily soluble in aqueous solutions of the sulphate, nitrate, and succinate of ammonia, and of chloride of ammonium. (Wittstein.)

PHOSPHATE *of protoxide* OF CERIUM.

I.) *di.* $2\,Ce\,O, H\,O, cPO_5$ Insoluble in water, or in a solution of phosphoric acid. Slightly soluble in chlorhydric and nitric acids. (Hisinger & Berzelius.)

II.) *tri.* $3\,Ce\,O, PO_5$ Occurs native as the mineral *Cryptolite*, which is insoluble in dilute nitric acid, but dissolves in concentrated sulphuric acid. (Wœhler.)

PHOSPHATE OF CHELIDONIN. Readily soluble in water, spirit, and absolute alcohol. Insoluble in ether. (Probst, *Ann. der Pharm.*, 1839, **29.** 127.)

PHOSPHATE OF CHLORANILIN. Tolerably soluble in water, and alcohol.

PHOSPHATE *of protoxide* OF CHROMIUM. Insoluble in water. Readily soluble in acids. (Moberg.)

*Meta*PHOSPHATE *of sesquioxide* OF CHROMIUM.

I.) Insoluble in water, and concentrated acids. $Cr_2\,O_3''', 3\,aPO_5$ (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 60.)

*Pyro*PHOSPHATE *of sesquioxide* OF CHROMIUM. $2\,Cr_2\,O_3''', 3\,bPO_5 + 7\,Aq$ Soluble in the strong mineral acids, in water acidulated with sulphurous acid, from which it is reprecipitated on boiling, and in aqueous solutions of pyrophosphate of soda, and caustic potash. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 149.) Insoluble in an aqueous solution of pyrophosphate of soda. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also, in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

PHOSPHATE *of sesquioxide* OF CHROMIUM.

I.) *ordinary precipitated.* $Cr_2\,O_3''', cPO_5 + 12\,Aq$, & $10\,Aq$, & $6\,Aq$ (Rammelsberg). Insoluble in water. Soluble in phosphoric acid, and is not precipitated from the acid solution on the addition of carbonate of ammonia. (T. Thomson, *Phil. Trans.*, 1827, Part I., pp. 210, 203.) Insoluble in water. Easily soluble in acids. It is not precipitated by ammonia from its acid solution when this contains at the same time citrate of soda. (Spiller.)

II.) "*acid.*" Soluble in water. (Vauquelin.)

*Pyro*PHOSPHATE *of sesquioxide* OF CHROMIUM & OF POTASH. Known only in solution. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 322.)

*c*PHOSPHATE OF CINCHONIDIN (of Pasteur). Difficultly soluble in cold water. (Winckler, from *Buchn. Rep.*, (2.) **49.** 1, in *Pharm. Central B.*, 1848, **19.** 311.)

Phosphate of Cinchonin. Readily soluble in water.

***Meta*Phosphate of Cobalt.**

I.) *Di*MetaPhosphate ? Insoluble in water, $2\,Co\,O, 2\,a''PO_5$ and dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 58.) Scarcely at all attacked by a boiling aqueous solution of sulphide of sodium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 352.)

II.) *Tri*MetaPhosphate. Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

III.) *Hexa*MetaPhosphate. Ppt. Soluble in an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

Persoz (*J. pr. Ch.*, 1834, **3.** 215) speaks of a meta (hexa ?) phosphate of cobalt soluble in ammonia-water.

***Pyro*Phosphate of Cobalt.** Soluble in ammonia-water [at least when in presence of pyrophosphate of nickel], from which solution alcohol precipitates it. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 158.) Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111 ; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Easily soluble in an aqueous solution of pyrophosphate of soda ; this red solution becomes blue when heated, but remains clear, and regains its red color on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 19.)

Phosphate of Cobalt.

I.) *di.* Insoluble in water. Soluble in phos- $2\,Co\,O, H\,O, cPO_5 + 5\,Aq$ phoric acid. (Berzelius, *Lehrb.*)

II.) *tri.* Soluble in phosphoric acid, and am- $3\,Co\,O, cPO_5$ monia-water.

Soluble in aqueous solutions of the salts of cobalt ; on boiling the solution thus obtained, a precipitate is formed, which redissolves completely on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.) Imperfectly soluble in aqueous solutions of chloride of ammonium and nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 98.) Decomposed by an aqueous solution of any salt of a sesquioxide, with formation of an insoluble phosphate of the sesquioxide employed ; when boiled with a solution of potash-alum it is completely decomposed in less than an hour ; with chrome alum the decomposition is more rapid, and with iron alum the decomposition is complete after a few minutes, even in the cold. Instead of the alums, any other salt of a sesquioxide may be employed, for example, nitrate of iron, tartrate of iron and of potash, &c. (Guignet, *C. R.*, **49.** 454.)

Phosphate *of sesquioxide* of Cobalt. Ppt.

***Meta*Phosphate of Cobalt & of Soda.**

I.) *Dimetaphosphate ?* Insoluble in water, and $6\,(Co\,O, aPO_5); Na\,O, aPO_5$ dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** pp. 57, 56.)

II.) *Trimetaphosphate.* Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

***Pyro*Phosphate of Cobalt & of Soda.** Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111 ; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate of Cobalt & of Zinc.

I.) $Co\,O, 2\,Zn\,O, cPO_5 + 6\,Aq$ Insoluble in water. (Domente.)

II.) $4\,Co\,O, 5\,Zn\,O, 9\,H\,O, 6\,cPO_5 + 9\,Aq$ Ppt.

Phosphate of Codein. Very soluble in $N\left\{\begin{matrix}C_{36}\,H_{20}\,O_6''\\H\end{matrix}\right.. H\,O, 2\,H\,O, cPO_5 + 3\,Aq$ water; from this solution it is precipitated on the addition of strong alcohol.

Phosphate of Coniin. Soluble in water.

***Meta*Phosphate of Copper.**

I.) *Dimetaphosphate.*

a = anhydrous. Insoluble in water, and dilute $2\,Cu\,O, 2\,a''PO_5$ acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 60.) Completely insoluble in water, and almost as insoluble in most acids, even when these are concentrated, and alkalies, being tolerably easily soluble only in ammonia-water, and hot concentrated sulphuric acid. It is not in the least decomposed by sulphuretted hydrogen water, but is decomposed by solutions of the alkaline sulphides ; best by sulphide of ammonium, less easily by the sulphides of sodium and potassium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 246, 241.)

b = hydrated. A concentrated aqueous solution $2\,Cu\,O, 2a''PO_5 + 8\,Aq$ of dimetaphosphate of soda being mixed with a solution of sulphate of copper occasions no precipitate, even after the mixture has stood for days. But on the addition of spirit, or on evaporating the solution, the precipitate separates out, and when once separated is completely insoluble in water. If a solution of chloride of copper be taken, instead of the sulphate, the metaphosphate of copper is much more readily formed, separating as hydrated crystals. Like the anhydrous salt, this is completely insoluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 256.)

II.) *Hexametaphosphate.* Ppt. Soluble in an excess of hexametaphosphate of soda, or of chloride of copper. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

***Pyro*Phosphate of Copper.** Soluble in $2\,Cu\,O, bPO_5 + 2\,Aq$ mineral acids, ammonia-water, and an aqueous solution of pyrophosphate of soda. Soluble, without decomposition, in an aqueous solution of sulphurous acid, from which it crystallizes out unaltered on boiling. Decomposed by a boiling aqueous solution of caustic potash. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 156.) Soluble, with combination, in an aqueous solution of pyrophosphate of soda. It is not decomposed in the least by a boiling solution of pyrophosphate of soda, but boiling ordinary (*c*) phosphate of soda decomposes it at once, *c* phosphate of copper being precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 110, 111 ; also, in *Schweigger's Journ. für Ch. u. Phys.*, **58.** pp. 129, 130.) Easily soluble in an aqueous solution of pyrophosphate of soda. Also soluble in a very large excess of a solution of sulphate of copper ; on heating this solution a precipitate is produced which does not disappear on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)

The anhydrous salt, obtained by gently igniting a mixture of oxide of copper and an excess of phosphoric acid, is completely insoluble in water, and very difficultly soluble in acids, even when these are concentrated. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 244.) Equally insoluble with the insoluble metaphosphate of copper of Maddrell, but is easily decomposed by sulphuretted hydrogen-water. (H. Rose, *Pogg. Ann.*, **76.** 14; for Rose's remarks upon the probability of the acid of this salt being different from common pyrophosphoric acid, see *Ibid.*, p. 13.) Rather easily decomposed by sulphuretted hydrogen-water. (Fleitmann, *loc. cit.*, p. 241.)

Phosphate of Copper.

I.) *mono* or "*acid.*"

II.) *di.* Insoluble in water. Soluble in phosphoric acid. Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 98.)
$2\,Cu\,O, H\,O, cPO_5 + 3\,Aq$

III.) *tri.* Insoluble in water. Easily soluble in acids, even in phosphoric, acetic, and sulphurous acids. Slightly soluble in aqueous solutions of the ammoniacal salts.
$3\,Cu\,O, cPO_5 + 3\,Aq$

Sparingly soluble in solutions of the salts of protoxide of copper; on heating the solution thus obtained, a precipitate falls, but disappears again as the solution cools. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.) Soluble in ammonia-water. (H. Rose, *Tr.*) Decomposed by an aqueous solution of any salt of a sesquioxide, with formation of an insoluble phosphate of the sesquioxide; these decompositions occur, however, less readily with phosphate of copper than with the phosphates of cobalt, nickel, and silver. (Guignet, *C. R.*, **49.** 455.)

IV.) *basic.*
$4\,Cu\,O, P\,O_5 + 2\,Aq$

V.) *basic.*
$3\,(Cu\,O, cPO_5); 2\,Cu\,O, H\,O$

VI.) $5\,Cu\,O, PO_5 + 3\,Aq$ Easily soluble in ammonia-water, and in nitric acid.

VII.) $6\,Cu\,O, PO_5 + 3\,Aq$

*Pyro*Phosphate of Copper & of Potash. Extremely soluble in water. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 324.)
$2\,Cu\,O, bPO_5; 2\,K\,O, bPO_5 + x\,Aq$

*TetraMeta*Phosphate of Copper & of Soda. As completely insoluble in water as dimetaphosphate of copper, and cannot be separated from its mixture with the latter. Completely, though difficultly, decomposed by digestion in an aqueous solution of sulphide of sodium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 356.)
$2\,Cu\,O, 2\,Na\,O, 4\,a^{IV}PO_5$

*Pyro*Phosphate of Copper & of Soda.

I.) $2\,Cu\,O, bPO_5; 2\,Na\,O, bPO_5 + 12\,Aq$
II.) $2\,Cu\,O, bPO_5; 3\,(2\,Na\,O, bPO_5) + 4\,Aq$ & $24\,Aq$
Soluble in water. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** pp. 323, 325; compare Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; or *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Very efflorescent. No. I. is less soluble than No. II., which is more soluble in water than pyrophosphate of soda. Insoluble in alcohol. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 387.)

III.) $3\,(2\,Cu\,O, bPO_5); 2\,Na\,O, bPO_5 + 7\,Aq$ Completely insoluble in water, or alcohol. Soluble in chlorhydric acid. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 387.)

Phosphate of Copper & *of sesquioxide* of Uranium. Easily soluble in acids.
$Cu\,O, 2\,Ur_2\,O_3, PO_5 + 8\,Aq$

Phosphate of Cresyl.

Phosphate of Cumidin.

Phosphate of Cystin.

Phosphate of Didymium. Insoluble in water. Very sparingly soluble in weak acids. Easily soluble in strong acids. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 163.)
$3\,Di\,O, cPO_5 + 2\,Aq$

*Pyro*Phosphate of Ethyl. Soluble in water, alcohol, and ether. (De Clermont, *Ann. Ch. et Phys.*, (3.) **44.** 332.)
$2\,C_4\,H_5\,O, bPO_5$

Phosphate of Ethyl.

I.) *mono.* *Vid.* EthylPhosphoric Acid.
$C_4\,H_5\,O, 2\,H\,O, cPO_5$

II.) *di.* *Vid.* *di*EthylPhosphoric Acid.
$2\,C_4\,H_5\,O, H\,O, cPO_5$

III.) *tri.* Miscible with water, by which it is soon decomposed however. (De Clermont.) Soon decomposed by cold, and at once by hot water. (Schiff.) Miscible with alcohol, ether, and even with water. (Vœgeli.)
(*EthylPhosphate of Ethyl.*)
$3\,C_4\,H_5\,O, cPO_5$

Phosphate of Ethylamin & of Magnesia. Much more soluble in water than the corresponding ammonia-salt. (E. Meyer.)
$2\,Mg\,O, \left(N \left\{\begin{matrix} C_4\,H_5 \\ H_2 \end{matrix}\right. . H\,O\right) cPO_5 + 10\,Aq$

Phosphate of *tetr*Ethylammonium.

*Pyro*Phosphate of Furfurin.

I.) = *anhydrous.*
$2\left(N_2 \left\{ (C_{10}\,H_4\,O_2'')_3 \right. . H\,O\right) bPO_5$

II.) = *hydrated.* Readily soluble in water, and alcohol.
$2\left(N_2 \left\{ (C_{10}\,H_4\,O_2'')_3 \right. . H\,O\right) bPO_5 + 2\,Aq$

Phosphate of Furfurin.

I.) *mono* or "*acid.*" Sparingly soluble in cold, readily soluble in hot water. Readily soluble in hot alcohol. Apparently insoluble in ether. (Svanberg & Bergstrand.)
$N_2 \left\{ (C_{10}\,H_4\,O_2'')_3 \right. . H\,O, 2\,H\,O, cPO_5$

II.) *di* or "*normal.*" Readily soluble in boiling water, and alcohol. Nearly insoluble in ether. (Svanberg & Bergstrand.)
$2\left(N_2 \left\{ (C_{10}\,H_4\,O_2'')_3 \right. . H\,O\right), H\,O, cPO_5$

III.) *tri.* Readily soluble in water, and alcohol. Sparingly soluble in ether. (Svanverg & Bergstrand.)
$3\left(N_2 \left\{ (C_{10}\,H_4\,O_2'')_3 \right. . H\,O\right) cPO_5$

Phosphate of Glaucin.

Phosphate of Glaucopicrin.

*Pyro*Phosphate of Glucina. Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate of Glucina. Permanent. Insoluble in water. Soluble in dilute acids, including phosphoric acid. (Berzelius's *Lehrb.*)
$2\,Gl_2\,O_3, 3\,PO_5$

*Pyro*Phosphate of Glucina & of Soda. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111 ; in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

*Pyro*PHOSPHATE OF GOLD & OF SODA. Soluble in water. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 326.)

PHOSPHATE OF GUANIN.

PHOSPHATE OF HARMALIN.

PHOSPHATE OF HYDRARGETHYL. *Vid.* Phosphate of MercurEthyl.

*Meta*PHOSPHATE *of protoxide* OF IRON.

I.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

II.) *Hexametaphosphate.* Appears to be soluble in water. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

*Pyro*PHOSPHATE *of protoxide* OF IRON. Ppt. Soluble in aqueous solutions of pyrophosphate of soda, and sulphate of protoxide of iron. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)

PHOSPHATE *of protoxide* OF IRON.

I.) *mono* or "*acid.*" Soluble in ammonia-water.
$FeO, 2\,HO, cPO_5$

$2\,FeO, HO, cPO_5$

II.) *di.* Insoluble in water, or in aqueous solutions of the ammoniacal salts. Does not appear to be soluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.) Soluble in ammonia-water and in dilute acids, including phosphoric and acetic acids. When no more than 1000 pts. of water are present diphosphate of soda precipitates it from solutions containing protoxide of iron. (Pfaff.) It is not precipitated from solutions which contain citrate of soda. (Spiller.)

Soluble in about 1000 pts. of a saturated aqueous solution of carbonic acid. This solubility is increased by adding dilute acetic acid to the carbonic-acid-water, so that 1 pt. of the phosphate dissolves in about 560 pts. of carbonic-acid-water containing less than $\frac{1}{500}$ pt. of commercial acetic acid. 1 pt. of it dissolves in 1666 pts. of carbonic-acid-water, which contains $\frac{1}{11}$ of its weight of acetate of ammonia. (Pierre, *Ann. Ch. et Phys.*, (3.) **36.** 78.)

Soluble in a boiling aqueous solution of sulphate of protoxide of iron. (Berzelius, *Lehrb.*) Easily soluble in aqueous solutions of the salts of protoxide of iron. On heating the solution thus obtained it deposits a voluminous precipitate which does not dissolve completely on cooling. (H. Rose, *Pogg. Ann.*, **76.** 25.)

(*Vivianite.*)
$3\,FeO, cPO_5 + 8\,Aq$

III.) *tri.* Insoluble in water. (Rammelsberg.) Easily soluble in chlorhydric and nitric acids. Decomposed by a hot solution of caustic potash.

$2\,FeO, HO, PO_5; 2\,(3\,FeO, PO_5)$

IV.) *Compound of Nos. II. and III.* Ppt. (Berzelius.)

$Fe_2O_3{}''', 3aPO_5$

*Meta*PHOSPHATE *of sesquioxide* OF IRON. Insoluble in water, or in dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 59.)

$2\,Fe_2O_3{}''', 3\,bPO_5 + 9\,Aq$

*Pyro*PHOSPHATE *of sesquioxide* OF IRON. Easily soluble in an aqueous solution of pyrophosphate of soda, the solution being partially decomposed on boiling. 16 pts. of the gelatinous precipitate (= 3 pts. of the salt dried at 100°) are dissolved by 3 pts. of pyrophosphate of soda. Also soluble in a solution of citrate of ammonia. (Parrish's *Pharm.*, p. 490.) Soluble in acids, in an aqueous solution of pyrophosphate of soda, in ammonia-water, and an aqueous solution of carbonate of ammonia. Insoluble in acetic acid, sulphurous acid, or a solution of chloride of ammonium ; but when precipitated by ammonia from its chlorhydric-acid solution it may be redissolved by adding an excess of ammonia-water. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 154.) Easily soluble in an aqueous solution of pyrophosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)

PHOSPHATE *of sesquioxide* OF IRON.

$Fe_2O_3{}''', 3\,HO, 2\,cPO_5 + 5\,Aq$

I.) *acid.* Insoluble in water. Soluble in ammonia-water, and very easily in chlorhydric acid. (Winckler.)

(*Ordinary precipitated. Sesqui.*)
$2\,Fe_2O_3{}''', 3\,HO, 3\,cPO_5$

II.) *di.* Insoluble in water. Soluble in acids. Soluble in 1500 pts. of boiling water ; easily soluble in dilute acids. (Bergmann.) Soluble in about 12500 pts. of carbonic-acid-water. (Pierre, *Ann. Ch. et Phys.* (3.) **36.** 78.) Easily soluble in aqueous solutions of the salts of sesquioxide of iron. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.) Soluble in phosphoric, and citric acids.

Easily soluble in chlorhydric acid, in which solution a precipitate is produced on the addition of phosphoric acid, but not by sesquichloride of iron. (Gladstone.) When moist it dissolves in warm sulphurous acid, and in a solution of sulphite of ammonia, though slowly and difficultly. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 79.) Insoluble in acetic acid. (Gay-Lussac, *Ann. Ch. et Phys.*, (2.) **49.** 324; Otto, *J. pr. Ch.*, **2.** 410, *note.*) Insoluble in acetic acid, or in aqueous solutions of ammoniacal salts. (Wittstein.) Does not appear to be soluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.) Partially soluble in a large excess of a solution of carbonate of soda. (H. Rose, *Tr.*) Soluble in ammonia-water, when in presence of diphosphate of soda ; also soluble in a solution of carbonate of ammonia.

It is not precipitated by ammonia when in presence of citrate of soda. (Spiller.) Decomposed by potash-lye, which abstracts a great part, but not the whole of its phosphoric acid. (H. Rose, *Tr.*) Diphosphate of soda precipitates sesquioxide of iron from solutions of its salts, even when these are diluted with 1500 pts. of water. (Pfaff.)

$Fe_2O_3{}''', cPO_5 + 4\,Aq$

III.) *tri.* Insoluble in water. Easily soluble in the stronger acids. (Rammelsberg.) Soluble in an aqueous solution of carbonate of ammonia, and in a mixture of caustic ammonia and phosphate of ammonia. Partially dissolved, with decomposition, in aqueous solutions of the caustic alkalies. (Berzelius's *Lehrb.*) Decomposed, with formation of No. IV., by a boiling dilute aqueous solution of caustic potash. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 419.)

Insoluble in water. Readily soluble in chlorhydric, and nitric acids. Slightly soluble in citric and tartaric acids. Insoluble in phosphoric acid or a hot aqueous solution of diphosphate of soda. Slightly soluble in a solution of tartrate of ammonia, but the solution is decomposed when heated. Soluble, in considerable quantity, with combination, in a solution of citrate of soda. (Heydenreich, *Amer. J. Pharm.*, (3.) **33.** 295)

IV.) *basic.* Insoluble in acetic acid. Soluble in an aqueous solution of acetate of iron.
$2\,(Fe_2O_3{}''', cPO_5)\,;\ Fe_2O_3 + 16\,Aq$

Decomposed, with formation of No. IV., by a boiling dilute aqueous solution of caustic potash. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 419.)

V.) *basic.* Easily soluble in dilute chlorhydric acid.
$Fe_2O_3{}''', cPO_5\,;\ Fe_2O_3 + 3\,Aq\ \&\ 20\,Aq$

VI.) *basic.* Unacted upon by a boiling dilute aqueous solution of caustic potash. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 419.) Insoluble, or rather very difficultly soluble in water, or in caustic ammonia. (H. Rose.)
$Fe_2O_3, cPO_5\,;\ 14\,Fe_2O_3$

PHOSPHATE *of protoxide* & *of sesquioxide* OF IRON. Ppt. Soluble in chlorhydric acid. (Rammelsberg, *Pogg. Ann.*, **64.** 415.)
$2\,(3\,FeO, cPO_5)\,;\ 3\,Fe_2O_3, 2\,cPO_5 + 24\,Aq$

PHOSPHATE *of protoxide* OF IRON & OF MANGANESE. Easily soluble in chlorhydric acid. (Berzelius.)
(*Triplite.*)
$3\,FeO, cPO_5\,;\ 3\,MnO, cPO_5$

PHOSPHATE OF IRON, OF MANGANESE, & OF SODA.
$Fe_2O_3{}''', cPO_5\,;\ 3\,(NaO, MnO), cPO_5 + Aq$

*Pyro*PHOSPHATE *of protoxide* OF IRON & OF SODA. Known only in solution. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 323.)

*Pyro*PHOSPHATE *of sesquioxide* OF IRON & OF SODA. Very soluble in water. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 322.) On the addition of spirit it is precipitated from the aqueous solution. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 390.)
$2\,Fe_2O_3{}''', 3\,bPO_5\,;\ 2\,(2\,NaO, bPO_5) + 7\,Aq$

PHOSPHATE OF LANTHANUM. Insoluble in water. Soluble in acids.

*Meta*PHOSPHATE OF LEAD.

I.) *Dimetaphosphate.* Almost insoluble in water. Soluble in nitric acid. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 253.)
$2\,PbO, 2\,a''PO_5$

II.) *Trimetaphosphate.* Somewhat less soluble in water than the corresponding silver salt. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 312.)
$3\,PbO, 3\,a'''PO_5 + 3\,Aq$

III.) *Tetrametaphosphate.* Completely insoluble in water. Much more easily decomposed and dissolved by acids than the metallic salts of dimetaphosphoric acid. Decomposed with the greatest facility by solutions of the alkaline sulphides, even in the cold. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 353.)
$4\,PbO, 4\,a^{iv}PO_5$

IV.) *Hexametaphosphate.* Ppt. Decomposed by sulphuretted-hydrogen-water. (Graham, *Elements.*) Insoluble in ammonia-water. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.) Ppt. Soluble in an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

*Pyro*PHOSPHATE OF LEAD. Ppt. Easily soluble, with combination, in an aqueous solution of pyrophosphate of soda. It is not decomposed in the least by a boiling solution of pyrophosphate of soda, but is decomposed at once by boiling with ordinary (c) phosphate of soda, c phosphate of lead being precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 110, 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** pp. 129, 130.) Soluble in nitric acid, and in aqueous solutions of caustic potash and of pyrophosphate of soda. Insoluble in ammonia-water, or in acetic or sulphurous acids. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 155.) Soluble, at first, in warm aqueous solutions of the alkaline pyrophosphates. On boiling the solution in pyrophosphate of soda, an insoluble precipitate is obtained. (Gerhardt, *Ann. Ch. et Phys.*, 1848, (3.) **22.** 506.) Easily soluble in an aqueous solution of pyrophosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)
$2\,PbO, bPO_5 + Aq$

PHOSPHATE OF LEAD.

I.) *di.* Insoluble in water or acetic acid. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 368.) Soluble in nitric acid, and in aqueous solutions of caustic potash and soda. [*Gm.*]
$2\,PbO, HO, cPO_5$

When recently precipitated, it is soluble in a cold aqueous solution of chloride of ammonium, but the lead may be precipitated from this solution by adding an excess of caustic ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 99.) More soluble in an aqueous solution of acetate of ammonia at 18.8° @ 25° than in pure water. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 182.) Phosphate of lead is soluble in a saturated aqueous solution of chloride of sodium, though to a smaller extent than sulphate of lead; from the solution thus obtained a double salt of chloride of lead and phosphate of lead crystallizes out. (Becquerel, *C. R.*, 1845, **20.** pp. 1524, 1523.) Insoluble in aqueous solutions of the salts of lead. (H. Rose, *Tr.*) Soluble in dilute nitric acid. Insoluble in acetic acid. (Persoz, *Chim. Moléc.*, p. 353.) Decomposed by chlorhydric and sulphuric acids. Not precipitated when in presence of citrate of soda. (Spiller.) Decomposed by sulphuretted-hydrogen-water. (Graham, *Elements.*)

When an equivalent of $2\,PbO, HO, PO_5$ is boiled with an equivalent of KO, SO_3, in aqueous solution, $\frac{12\cdot18}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 335.)

II.) *tri.* Insoluble in water, acetic acid, or ammonia-water. Soluble in nitric acid. (Fresenius, *Quant.*, p. 159.) Easily decomposed by sulphuretted-hydrogen-water. (Graham, *Elements.*)
$3\,PbO, cPO_5$

When an equivalent of $3\,PbO, PO_5$ is boiled with an equivalent of $NaO, 3\,CO_2$, in aqueous solution, $\frac{7\cdot87}{100}$ of it may be decomposed. While, on the other hand, $PbO, 3\,CO_2$ boiled with $3\,NaO, PO_5$ may be decomposed to the extent of $\frac{64\cdot7}{100}$. An equivalent of $3\,PbO, PO_5$ boiled with an equivalent of teroxalate of potash may be decomposed to the extent of $\frac{85\cdot27}{100}$; while, on the other hand, an equivalent of $PbO, 3\,\overline{Ox}$ when boiled with $3\,KO, PO_5$ may be decomposed to the extent of $\frac{58}{100}$. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** pp. 351, 354.)

*DiMeta*PHOSPHATE OF LEAD & OF SODA. Easily decomposed.

*Pyro*PHOSPHATE OF LEAD & OF SODA.

a.) Soluble in water. (Stromeyer, *loc. inf. cit.*)

$b = PbO, NaO, bPO_5$ Obtained by boiling a, i. e. the solution of pyrophosphate of lead in pyrophosphate of soda. It is insoluble in boiling water. (Gerhardt, *Ann. Ch. u. Phys.*, 1848, (3.) **22.** 506.)

*Meta*PHOSPHATE OF LIME.

I.) *anhydrous.* *Dimetaphosphate?* Insoluble in

$Ca\,O, aPO_5$ water, and dilute acids. Decomposed by warm concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 61.) Not decomposed by digestion in solutions of the alkaline carbonates. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 352.)

II.) *Dimetaphosphate.* $2\,Ca\,O, 2\,a''PO_5 + 4\,Aq$ Insoluble in water. Not perceptibly attacked by concentrated nitric and chlorhydric acids. Decomposed by warm concentrated sulphuric acid. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 256.)

III.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

IV.) *Hexametaphosphate.* The hydrated salt is insoluble in water. (Graham, *Phil. Trans.*, 1833, **123.** 280.) Completely soluble in an aqueous solution of hexametaphosphate of soda. Soluble in chlorhydric acid. (H. Rose, *Pogg. Ann.*, 1849, **76.** 3; compare also, *ibid.*, pp. 5, 6.)

*Pyro*Phosphate of Lime. $2\,Ca\,O, bPO_5 + Aq\ \&\ 4\,Aq$ Somewhat soluble in water. Completely soluble in nitric and chlorhydric acids; also soluble in saturated sulphurous acid. Insoluble in acetic acid, or in an aqueous solution of pyrophosphate of soda. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 145.) Insoluble in an aqueous solution of pyrophosphate of soda, or, rather only very slightly soluble therein when recently precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also, in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

The precipitate produced by chloride of calcium in a solution of pyrophosphate of soda is soluble in a very large excess of the latter, but the clear solution thus obtained becomes cloudy on standing, and after 24 hours contains in solution only a very small quantity of the lime salt. (H. Rose, *Pogg. Ann.*, 1849, **76.** 16.) Insoluble in water, or an aqueous solution of pyrophosphate of soda. When recently precipitated it dissolves in acetic acid, though considerably more difficultly than the ordinary (*c*) triphosphate; but after a time it separates out again in crystals, which dissolve still more difficultly than the original ppt, when more acetic acid is added. Less soluble in *warm* than in cold acetic acid. Even after drying, it is soluble to no inconsiderable extent in acetic acid. Soluble in nitric and chlorhydric acids. On heating the acid solution the pyrophosphoric acid is gradually, though incompletely, changed to the ordinary c modification. (Baer, *Pogg. Ann.*, 1848, **75.** pp. 155 – 159.) Insoluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.)

Phosphate of Lime.

I.) *mono* or "*acid.*" $Ca\,O, 2\,H\,O, cPO_5$ Hygroscopic. Soluble in water. Precipitated, with decomposition, by alcohol.

Glacial acetic acid precipitates it completely from the aqueous solution, even when this is mixed with nitric acid. (Persoz, *Chim. Moléc.*, p. 347; compare *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

The common notion that triphosphate of lime can be decomposed only so far as is necessary for the formation of the mono-salt, is erroneous, the degree of decomposition being only dependent upon the concentration and quantity of the acid. If a somewhat concentrated solution of monophosphate of lime be mixed with concentrated sulphuric acid, an abundant precipitate of sulphate of lime will be produced and an almost complete decomposition of the salt ensue, so that if enough sulphuric acid has been added the lime will be almost entirely removed from the solution, and the filtrate, after having been neutralized with ammonia, will no longer afford a precipitate on the addition of oxalate of ammonia, although a trace of lime is still contained in it. (Berzelius, *Lehrb.*, **3.** 409.)

II.) *di.* $2\,Ca\,O, H\,O, P\,O_5 + 4\,Aq$ Insoluble, or extremely sparingly soluble in water.

"The solubility of bibasic phosphate of lime is $\frac{1}{1{\cdot}000{\cdot}000}$." (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 346.) Not completely insoluble, but only difficultly soluble, in water, and acetic acid. Easily soluble in nitric and chlorhydric acids. (Baer, *Pogg. Ann.*, 1848, **75.** pp. 153, 154, 156 *note.*) When boiled with water it is decomposed to the soluble acid-salt (No. I.) and the insoluble tri-salt (No. V.). (Bœdeker.)

Insoluble in alcohol. Very readily soluble in acids, even in carbonic-acid-water; but is especially soluble in strong acids, and those which form soluble salts with lime.

Difficultly soluble in acetic acid; easily soluble in chlorhydric acid. It is soluble in aqueous solutions of various salts, — especially chloride of ammonium, and of many organic matters: this is of interest, since it is probable that this salt is left in the soil by the decay of vegetables. (Otto.) Insoluble in an aqueous solution of diphosphate of soda; but traces of it are dissolved by a solution of chloride of calcium. (H. Rose, *Pogg. Ann.*, 1849, **76.** 24.)

When one equivalent of $2\,Ca\,O,\ H\,O,\ PO_5$ is boiled with an equivalent of $K\,O, 2\,CO_2$, in aqueous solution, $\frac{33{\cdot}28}{100}$ of it may be decomposed; when boiled with an equivalent of $Na\,O,\ 2\,C\,O_2$ $\frac{25{\cdot}36}{100}$ it may be decomposed. While, on the other hand, when an equivalent of $Ca\,O,\ 2\,C\,O_2$ is boiled with one of $2\,K\,O,\ H\,O, P\,O_5$ $\frac{41}{100}$ of it may be decomposed, or with an equivalent of $2\,Na\,O,\ H\,O, P\,O_5$ $\frac{39}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3) **51.** pp. 348 – 354.)

III.) *Compound of Nos.* I. & II. $2\,(Ca\,O, 2\,H\,O, PO_5); 2\,Ca\,O, H\,O, PO_5$ Decomposed by water, which dissolves out the mono-salt (No. I.). Insoluble in alcohol. (Berzelius, *Lehrb.*, **3.** 408.)

IV.) $3\,Ca\,O, 3\,H\,O, 2\,cPO_5 + Aq$ Insoluble in alcohol. (Raewsky.)

V.) *tri.* Insoluble in water.
$3\,Ca\,O, cPO_5\ \& + 2\,Aq$ (*Exists in bones.*) When recently precipitated, it is soluble to a very slight extent in pure water, so that the liquid becomes cloudy on the addition of nitrate of lead. (R. Phillips.) It dissolves more readily in water containing starch or glue. (Vauquelin.) Soluble in no inconsiderable quantity in liquids which contain various organic, non-acid substances in solution. (Berzelius, *Lehrb.*, **3.** 407.) Bone-dust is dissolved, to a certain extent, when in contact with water, even that which contains no carbonic acid. This is probably, for the most part, owing to the solvent power of the products of putrefaction of the gelatine of the bone. (Wœhler, *Ann. Ch. u. Pharm.*, 1856, **98.** 143.) Somewhat soluble in aqueous solutions of many organic substances. (Ot. Gr.) Slightly soluble in aqueous solutions of the ammoniacal salts.

When recently precipitated, it is dissolved in small quantity by a cold solution of chloride of ammonium (Wœhler); also by solutions of succinate or nitrate of ammonia. (Wittstein.) As good as insoluble in water, but somewhat soluble in liquors containing ammoniacal salts; in a single experiment where a weighed portion of it was dissolved in chlorhydric acid and reprecipitated by ammonia-water, nearly 5% of it remained dissolved in the fluid. (Rammelsberg, *Pogg. Ann.*, 1845, **64.** 421.) Even the anhydrous salt is dissolved by long-continued boiling with chloride of ammonium, or nitrate or succinate of ammonia. (Huenefeld; Wittstein.) Readily soluble, when recently precipitated, in cold aqueous solutions of chloride of ammonium, and nitrate of ammonia; from the solution in chloride of ammonium it may be nearly, if not entirely precipitated by adding an excess of caustic ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 95, 99, 334.) Completely soluble in a boiling aqueous solution of chloride of ammonium, with evolution of ammonia. (Fuchs; Demarçay, *Ann. der Pharm.*, 1834, **11.** 251.) Soluble, when recently precipitated, in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 315.) When boiled for several hours with a solution of sulphate of ammonia, it is decomposed, soluble monophosphate being dissolved while sulphate of lime separates. (Delkeskamp; Morveau.) Partially decomposed when boiled with aqueous solutions of carbonate of potash or of soda. (Dulong, *Ann. de Chim.*, **82.** 278.) Sparingly soluble in an aqueous solution of common salt. (Thomson.) Soluble in an aqueous solution of normal citrate of soda. (Spiller.) Soluble to a certain extent, at the ordinary temperature, in a moderately concentrated aqueous solution of sucrate of lime. Although the phosphate dissolves to a notable extent in the sucrate, even after having been ignited, it is, nevertheless, more readily soluble when recently precipitated and in the gelatinous state. (Bobierre, *C. R.*, 1851, **32.** 859.) Insoluble in pure water, but is easily soluble in water which contains chloride of sodium or an ammonia salt. In water which contains sulphate of ammonia it is as easily soluble as gypsum. Easily soluble also in carbonic-acid-water; 1 litre of water saturated with carbonic acid dissolves 0.6626 grm. of bone-earth, of which 0.5 grm. separates out at the temperature of boiling, while 0.1626 grm. remains dissolved after the solution has become cold. (Liebig, *Ann. Ch. u. Pharm.*, **61.** 128.)

Water saturated with carbonic acid at 10° and the ordinary atmospheric pressure dissolves $\frac{75}{100000}$ of its weight (i. e. $\frac{1}{1333}$ of bone phosphate of lime. This solution is decomposed on heating, also when the carbonic acid is neutralized with potash or soda. The phosphate is also dissolved, though in lesser quantity, by carbonic acid water which is charged with carbonate of lime. (Lassaigne, *Ann. Ch. et Phys.*, (3.) **25.** 348.) Partially decomposed when boiled with aqueous solutions of the chlorides of cobalt, nickel, zinc, manganese, or copper, with formation of insoluble phosphates of these metals. (Demarçay, *Ann. der Pharm.*, 1834, **11.** 250.)

When an equivalent of $3\,CaO, PO_5$ is boiled with an equivalent of $NaO, 3\,CO_2$, in aqueous solution, $\frac{7.52}{100}$ of it may be decomposed. While, on the other hand, when $CaO, 3\,CO_2$ is boiled with $3\,NaO, PO_5$ $\frac{39.21}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 351.)

It is soluble in acids, but the readiness with which this solution is accomplished varies greatly according to the state of aggregation of the phosphate; this last is of special moment as regards weak acids: thus, the mineral apatite is dissolved only with extreme difficulty in carbonic-acid-water, in which bone-earth dissolves more readily, and the freshly precipitated salt very much more easily.

Soluble, with decomposition, in sulphuric, chlorhydric, nitric, and phosphoric acids. Sparingly soluble in strong acetic acid. (Wenzel.) When recently precipitated, terbasic phosphate of lime is very easily soluble in acetic acid, being very much more soluble therein than the diphosphate, but after having become dry it is only very difficultly soluble in acetic acid. (Baer, *Pogg. Ann.*, 1848, **75.** pp. 156 *note*, 153.) From the nitric-acid solution, glacial acetic acid precipitates the monophosphate (No. I.). (Persoz, *Chim. Molée.*, p. 347.) Soluble in lactic acid, even when this is dilute. (Cap & Henry.) The solvent power which lactic acid exerts over basic phosphate of lime, far exceeds that of acetic acid, and is indeed very considerable, — a fact long ago asserted by Berzelius (in his *Lehrbuch*), and directly proved by the experiments of Gay-Lussac (*Pogg. Ann.*, **31.** 399), although its accuracy has been called in question by Liebig. (Lehmann, in his *Phys. Chem.*, London, 1851, **1.** 104.) On the other hand, Baer (*Pogg. Ann.*, **75.** 156 *note*), remarks that Liebig's statement (in *Geiger's Handbuch der Pharm.*, **1.** 815) "that the property of dissolving recently precipitated phosphate of lime, in large quantity is possessed only by lactic, and not by acetic acid," should be corrected. Soluble in many of the vegetable acids, as tartaric, malic, lactic, &c. (Crum.)

More readily soluble in concentrated than in dilute nitric acid. Very much more soluble in concentrated nitric acid than phosphate of baryta.

In the experiments tabulated below an excess of precipitated phosphate was digested during 24 hours with acid of the indicated strength.

1 pt. of phosphate of lime dissolves, at 16.25 @ 17.5°, in	of a mixture of 1 pt. of nitric acid of 1.23 sp. gr. at 17.5° and pts. of water.	100 pts. of nitric acid, of 1 23 sp. gr., mixed with the amts. of water in col. 2, dissolve pts. of phosphate of lime.
2.72 pts. . . .	0	36.785
4.23	0.827	43.226
10.25	3.309	42.050
15.45	5.791	43.954
20.34	8.273	45.589
20.82	10.	52.831
30.64	10.754	56 939
26.48	13.	52.857
32.14	13.236	44.299
36.06	15.718	46.368
127.81 . . .	40.	32.078

As is indicated in the 3d column of the table, a somewhat diluted acid dissolves a larger amount of phosphate in proportion to the real acid contained in it than is the case with a more concentrated acid. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1833, **67.** pp. 50 – 54.)

The solvent power of chlorhydric acid for phosphate of lime is increased, up to a certain point, as this is diluted with water in a more decided manner than is the case with nitric acid, as may be seen by the following table: —

1 pt. of phosphate of lime dissolves, at 16.25 @ 17.5°, in	of a mixture of 1 pt. of chlorhydric acid of 1 155 sp. gr. at 15.63° and pts. of water.	100 pts. of chlorhydric acid of 1.155 sp. gr., mixed with amts. of water given in col. 2 dissolve pts. of phosphate of lime.
3.95 pts.	0	25.320
4.44	1	45.010
8 02	4	62.311
12.35	7	64.753
15.97	10	68.899
19.47	13	71.907
24.44	16	69.545
28.68	19	69.719

(Bischof, *loc. cit.*, pp. 55 – 56.) In citing these experiments, Gmelin (*Handbook*, **3.** 194) remarks that theoretically "72.8 pts. (2 At.) of anhydrous H Cl should decompose and dissolve 155.4 pts. (1 At.) of the lime salt: —

"$3\,Ca\,O, P\,O_5 + 2\,H\,Cl = Ca\,O, P\,O_5 + 2\,(Ca\,O, H\,Cl)$; 100 pts. of aqueous chlorhydric acid of sp. gr. 1.153 contain 30.9 pts. of anhydrous acid; 72.8 : 155.4 = 30.9 : 66; 100 pts. of the aqueous acid of sp. gr. 1.153 should, therefore, when diluted to any extent, dissolve 66 pts. of the lime salt. With this the 3d column accords upon the whole; but why the acid when moderately diluted should dissolve more, and when not diluted so much less than 66 pts., remains to be explained. Similar results are obtained with nitric acid: 108 pts. (2 Ats.) of anhydrous $N\,O_5$ should decompose 155.4 pts. of the salt; 100 pts. of acid of sp. gr. 1.23 contain 31 pts. of the real acid; and 108 : 155.4 = 31 : 44.5."

Decomposed, with partial solution (see under No. I.), by sulphuric acid. Completely decomposed to sulphate of lime and free phosphoric acid when treated with a mixture of sulphuric acid and alcohol. (Berzelius, *Lehrb.*, **3.** 409.)

VI.) *Compound of Nos.* II. *&* IV.) Ppt. Soluble in nitric and chlorhydric acids either concentrated or dilute, though most readily in acid which has been diluted to a certain extent, and in general resembles, in solubility, the tri-salt (No. V.). (Berzelius, *Lehrb.*, **3.** 406.)

$2\,Ca\,O, H\,O, P\,O_5;\ 2\,(3\,Ca\,O, PO_5)$

VII.) *Salt of Fleitmann & Henneberg's* 1*st acid.* Insoluble precipitate. On heating the salt more strongly than is necessary to expel its water it becomes insoluble in acids. (F. & H., *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 331, 332, 329.)

"$6\,Ca\,O, 4\,PO_5 + x\,Aq$."

PHOSPHATE OF LIME & OF POTASH. Soluble in water. (Saussure; Berthollet.)

$2\,K\,O, Ca\,O, cPO_5$

*TriMeta*PHOSPHATE OF LIME & OF SODA. Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

$2\,Ca\,O, Na\,O, 3\,a'''PO_5 + x\,Aq$

*Pyro*PHOSPHATE OF LIME & OF SODA. Insoluble in water, or an aqueous solution of pyrophosphate of soda; but is not insoluble in acetic acid. Easily soluble in nitric and chlorhydric acids. (Baer, *Pogg. Ann.*, 1848, **75.** 160.)

$Ca\,O, Na\,O, bPO_5 + 4\,Aq$

PHOSPHATE OF LIME & *of sesquioxide* OF URANIUM. Soluble in nitric acid. (Berzelius.)

$Ca\,O, 2\,Ur_2\,O_3, cPO_5 + 8\,Aq$

PHOSPHATE OF LITHIA.

I.) *mono.* Deliquescent. Readily soluble in water. (Gmelin; Rammelsberg.)

$Li\,O, 2\,H\,O, cPO_5$

II.) *di.* Nearly insoluble in water. (C. Gmelin.) Soluble in 833 pts. of water at 12°. (Rammelsberg.)

$2\,Li\,O, H\,O, cPO_5$

III.) $5\,Li\,O, H\,O, 2\,cPO_5 + 2\,Aq$ Soluble in 200 pts. of water. (Rammelsberg.)

IV.) *tri.* Soluble in 2539 pts. of pure water at the ordinary temperature, and in 3920 pts. of water containing caustic ammonia. Readily soluble in aqueous solutions of ammoniacal salts. (W. Mayer, *Ann. Ch. u. Pharm.*, **98.** 201.) Very soluble in carbonic-acid-water, and in acids even when these are very dilute. (Troost.)

$3\,Li\,O, cPO_5$
(This is the only phosphate of lithia, the existence of which has been well proved.)

This salt is liable to retain portions of phosphate or carbonate of potash, soda, and ammonia, with considerable tenacity, though by thorough washing the foreign salt may be entirely removed. This fact led Berzelius and Rammelsberg to describe as double salts several such mixtures, for example, $Na\,O, Li\,O, P\,O_5$ (Berzelius); $3\,Na\,O, 3\,Li\,O, P\,O_5$; and $3\,Li\,O, P\,O_5$; $2\,Li\,O, H\,O, P\,O_5 + 2\,Aq$ (Rammelsberg), which should henceforth not be admitted as salts. (W. Mayer, *Ann. Ch. u. Pharm.*, **98.** 193.) [It may not be uninteresting, however, to cite what is known of the solubility of these mixtures, thus: the] Phosphate of Lithia and of Soda (of Berzelius) "$Na\,O, Li\,O, P\,O_5$" (which Rammelsberg, like Mayer, long ago found to be of very variable composition), is scarcely at all soluble in cold, but more soluble in hot water. It is nearly insoluble in water containing diphosphate of soda. (Berzelius.)

Soluble in 1396 pts. of water at 15°.
" 1233 " 60°.
" 951 " 100°.
(Brandes.)

And the compound $3\,(Na\,Li\,O)\,cPO_5$ is very difficultly soluble in water. Soluble in 1396 pts. of water at 15°; but more soluble in hot water. (Brandes.) Soluble in chlorhydric acid.

*Meta*PHOSPHATE OF MAGNESIA.

I.) *Dimetaphosphate.*

a.) *anhydrous.* Almost insoluble in water, and dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** pp. 62, 54.) It is not decomposed in the least when digested for days in aqueous solutions of the alkaline carbonates or c phosphates. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 352, 260.)

$2\,Mg\,O, 2\,a''PO_5$

Wach (*Schweigger's Journ. für Ch. u. Phys.*, 1830, **59.** 304) also appears to have encountered this salt. He describes it as being rather difficultly soluble in cold water, and rather difficultly soluble in acids, even when these are boiling; dissolving best in a considerable excess of hot sulphuric acid. But an aqueous solution of phosphoric acid does not dissolve it, not even when the mixture is boiled to dryness and then ignited.

Gregory (*Ann. Ch. u. Pharm.*, **54.** 97) has described as phosphate of magnesia a compound which has since been shown by Maddrell to contain soda. See METAPHOSPHATE OF MAGNESIA & OF SODA.

b.) *crystallized.* Insoluble in water. Somewhat more easily decomposed by acids than the zinc and manganesian salts. (Fleitmann, *loc. cit.*, p. 259.)

$2\,Mg\,O, 2\,a''PO_5 + 9\,Aq$

II.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

III.) *Hexametaphosphate.* Appears to be soluble in water. (H. Rose, *Pogg. Ann.*, 1849, **76.** pp. 3, 56; compare Wach, *Schweigger's Journ. für Ch. u. Phys.*, 1830, **59.** pp. 302, 304.)

*Pyro*PHOSPHATE OF MAGNESIA. Permanent. $2\,MgO, bPO_5 + 3\,Aq$ Somewhat soluble in water. Completely soluble in nitric, and chlorhydric acid, in sulphurous acid, and in an aqueous solution of pyrophosphate of soda. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 146.) Soluble in aqueous solutions of pyrophosphate of soda, and sulphate of magnesia and in an excess of carbonate of ammonia. (Wach, *Schweigger's Journ. für Ch. u. Phys.*, 1830, **59.** 300.) Easily soluble in aqueous solutions of pyrophosphate of soda, and sulphate of magnesia, but on boiling these solutions precipitates are formed which do not disappear on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 17.) The anhydrous salt is scarcely at all soluble in water. (Fresenius, *Quant.*, p. 130.) The anhydrous salt obtained by igniting mono c phosphate of magnesia is insoluble in acids. (Graham, cited by Gregory, *Ann. Ch. u. Pharm.*, 1845, **54.** 98 *note.*) But when prepared by igniting phosphate of ammonia and of magnesia ($2\,MgO, NH_4O, PO_5$) it is readily soluble in chlorhydric and nitric acids. (Fresenius, *Quant.*)

PHOSPHATE OF MAGNESIA.

I.) *mono.* Soluble in water. Tolerably soluble $MgO, 2\,HO, cPO_5$ in spirit. (Gregory, *Ann. Ch. u. Pharm.*, 1845, **54.** 94.)

II.) *di.*

a = gelatinous ppt. Decomposed by boiling water $2\,MgO, HO, cPO_5 + 6\,Aq$ to an insoluble basic, and a soluble acid salt. (Riffault; Rammelsberg, *Pogg. Ann.*, 1845, **64.** 259.)

b = crystals. Efflorescent. Soluble in 322 pts. $2\,MgO, HO, cPO_5 + 14\,Aq$ of water at 7.2°, but on heating the solution to 48.8° or less, it becomes turbid, and at 100° a cloudy precipitate subsides, the solution containing only 1 pt. of the crystallized phosphate in 498 pts. of water at 100°. This precipitation also occurs when the solution contains an excess of phosphate of soda or sulphate of magnesia. Much more soluble in acids than in water, dissolving with facility even in very dilute acetic, oxalic, phosphoric, chlorhydric, nitric or sulphuric acid. The addition of the smallest quantity of any of these acids to the aqueous solution prevents the appearance of the usual precipitate when the solution is heated. When an aqueous solution, from which a precipitate has been deposited at 100°, is heated to a higher temperature in a close vessel, a new precipitate will form. When a solution which has been heated to 100° is allowed to cool upon the precipitate which has been produced, a portion of the latter will redissolve. Thus, while 2.3 grains of precipitated phosphate were obtained by filtering at 100°, only 2 grains were obtained from an equal quantity of the same solution which had been allowed to become cold, with occasional agitation, before filtration. In appearance the precipitate had suffered a very great reduction. (Graham, *Phil. Mag.*, 1827, (2.) **2.** 20 *et seq.*) 100 pts. of water at 15.5° dissolve 1.1 pts. of it, and at 15.5° 6.6 pts. (Ure's *Dict.*) Soluble in 15 pts. of cold water, and in much less hot water. (Dumas, *Tr.*, **6.** 288; also Schubarth, *Tech.*)

Insoluble in alcohol. (Berzelius's *Lehrb.*) Soluble in aqueous solutions of magnesia salts, but insoluble in a solution of phosphate of soda. On boiling the clear solution, obtained by means of sulphate of magnesia, a copious precipitate is produced, which at first disappears again completely on cooling, and is again produced on the application of heat; but after the experiment has been repeated a number of times, the precipitate formed by heat does not disappear again completely on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 24.) It is not precipitated from solutions containing citrate of soda. (Spiller.) When recently precipitated, it is soluble in a hot aqueous solution of chloride of ammonium, and an excess of caustic ammonia does not reprecipitate it completely from this solution; less readily soluble in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 99.)

III.) *tri.* Insoluble in water, or in aqueous $3\,MgO, cPO_5 + 5\,Aq$ solutions of the alkaline salts. Readily soluble in dilute acids, excepting acetic acid, in which it is but difficultly soluble. (Berzelius's *Lehrb.*) Easily soluble in acids, even after having been melted. (Gregory, *Ann. Ch. u. Pharm.*, 1845, **54.** 98 *note.*)

IV.) *Salt of Fleitmann & Henneberg's 1st acid.* "$6\,MgO, 4\,PO_5 + x\,Aq$" Insoluble precipitate. On heating the salt more strongly than is necessary to expel its water it becomes insoluble in acids. (F. & H., *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 331, 332, 329.)

PHOSPHATE OF MAGNESIA & OF NICKEL. Insoluble in ammonia-water.

*Meta*PHOSPHATE OF MAGNESIA & OF SODA.

I.) *Mono? or Di? metaphosphate.* Almost insoluble $3\,(MgO, aPO_5)\,;\ NaO, aPO_5$ in water, chlorhydric acid, and aqua-regia. Soluble in concentrated sulphuric acid, and this solution may be diluted with water. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 54.) Completely insoluble in cold water, and cold phosphoric acid. Almost completely insoluble in chlorhydric acid or aqua-regia, even when these are hot. Insoluble in an aqueous solution of carbonate of ammonia. (Gregory, *Ann. Ch. u. Pharm.*, 1845, **54.** pp. 97, 95.)

II.) *Trimetaphosphate.* Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

*Pyro*PHOSPHATE OF MAGNESIA & OF SODA.

a.) Soluble in water, but the solution soon decomposes when left to itself. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 322.)

b = basic? Ppt. Slightly soluble in water, and ammonia-water. Insoluble in alcohol. Easily soluble in an aqueous solution of pyrophosphate of soda, and in chlorhydric and nitric acids. (Baer, *Pogg. Ann.*, 1848, **75.** pp. 168, 164.)

*Meta*PHOSPHATE OF MANGANESE.

I.) *Dimetaphosphate.*

a.) anhydrous. Insoluble in water, and dilute $2\,MnO, 2\,a''PO_5$ acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 58.) Like the copper salt, it is insoluble in almost all reagents. Much less easily decomposed by alkaline solutions than the copper salt. Scarcely attacked by a warm solution of sulphide of sodium, and not much more easily by sulphide of ammonium. A solution of carbonate of soda decomposes it more readily. (Fleitmann, *Pogg. Ann.*, **78.** 349.)

b = hydrated. Resembles the copper salt, *q. v.* (Fleitmann, *loc. cit.*, p. 257.)
$2\,Mn\,O, 2\,a''PO_5\ \& + 8\,Aq$

II.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

III.) *Hexametaphosphate.* Ppt. Soluble in an aqueous solution of hexametaphosphate of soda. (H Rose, *Pogg. Ann.*, 1849, **76.** 4.)

*Pyro*Phosphate of Manganese. Soluble in sulphurous acid, in an aqueous solution of pyrophosphate of soda, and in the strong mineral acids. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 150.) Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Soluble in an aqueous solution of pyrophosphate of soda, but insoluble in a solution of sulphate of manganese. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)
$2\,Mn\,O, bPO_5 + 3\,Aq$

Phosphate of Manganese.

I.) *mono* or "*acid.*" Readily soluble in water. Decomposed by alcohol, which abstracts phosphoric acid. (Heintz.)
$Mn\,O, 2\,H\,O, cPO_5 + 2\,Aq$

II.) *di.* Permanent. When boiled with water it is decomposed to a soluble acid and an insoluble basic salt. (Bœdeker.) Difficultly soluble in water, or acetic acid. Insoluble in alcohol. Readily soluble in strong mineral acids. (Heintz.) Slightly soluble in an aqueous solution of carbonate of ammonia, from which it is reprecipitated on boiling. Decomposed, with oxidation, by a boiling solution of caustic potash. (Berzelius, *Lehrb.*)
$2\,Mn\,O, H\,O, cPO_5 + 6\,Aq$

III.) *tri.* Sparingly soluble in water. Insoluble in alcohol. Soluble in an aqueous solution of carbonate of ammonia, from which it is deposited when the solution is boiled. Soluble in a cold aqueous solution of chloride of ammonium; also partially soluble in a cold solution of nitrate of ammonia, but a portion of it is reprecipitated in either case on boiling. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 98, 335.) Also soluble in solutions of sulphate and succinate of ammonia.
$3\,Mn\,O, cPO_5 + 7\,Aq$

Soluble in acetic and phosphoric acids, and with greater facility in the strong mineral acids. (Heintz.) Slightly soluble in aqueous solutions of the salts of protoxide of manganese, the solution depositing a precipitate on boiling which disappears again as the solution cools. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.)

Phosphate *of sesquioxide* of Manganese. Insoluble in acids, excepting chlorhydric acid. Decomposed by warm potash-lye. (Hermann.)
$Mn_2\,O_3, 2\,H\,O, 3\,cPO_5$

*TriMeta*Phosphate of Manganese & of Soda. Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

*Pyro*Phosphate *of protoxide* of Manganese & of Soda. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st. vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate of Melamin. Very soluble in boiling water.

Phosphate of Melanil. Very easily soluble in water. (Hofmann, *J. Ch. Soc.*, **1.** 293.)

Phosphate of MeNaphthalamin. Very soluble in alcohol, and ether.

Phosphate of MercurEthyl. Readily soluble in water. (Duenhaupt.)
(*Phosphate of HydrargEthyl.*)

*Meta*Phosphate *of dinoxide* of Mercury.

I.) *Trimetaphosphate.* Ppt. Does not appear to be very insoluble. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, **76.** 9.)

II.) *Hexametaphosphate.* Ppt. Soluble in an excess of an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

*Meta*Phosphate *of protoxide* of Mercury.

I.) *Trimetaphosphate.* Ppt. Does not appear to be very insoluble. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

II.) *Hexametaphosphate.* Ppt. (H. Rose, *Pogg. Ann.*, **76.** 4.) Insoluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 359.)

*Pyro*Phosphate *of dinoxide* of Mercury. Ppt. Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also, in *Schweigger's Journ. fur Ch. u. Phys.*, **58.** 130; H. Rose, *Pogg. Ann.*, **76.** 17.) When recently precipitated it is soluble in an aqueous solution of pyrophosphate of soda, the solution undergoing decomposition when boiled; but is insoluble therein after having been dried at 100°. Soluble in nitric acid. Decomposed by chlorhydric acid. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 159.)
$2\,Hg_2\,O, bPO_5 + Aq$

*Pyro*Phosphate *of protoxide* of Mercury. Insoluble in water or alcohol. Soluble in phosphoric, chlorhydric, and nitric acids.
$2\,Hg\,O, bPO_5$

Soluble in 6 pts. of an aqueous solution of chloride of ammonium (Trommsdorff); also soluble in solutions of the nitrate, sulphate, and carbonate of ammonia (Wittstein); and of iodide of potassium. (Melsens, *Ann. Ch. et Phys.*, (3.) **26.** 221.) It is precipitated in presence of 500 pts. of water. (Pfaff.) Insoluble in water acidulated with nitric acid. When treated with an aqueous solution of pyrophosphate of soda it is rendered basic. (H. Rose, *Pogg. Ann.*, 1849, **76.** 17.) Insoluble in an aqueous solution of pyrophosphate of soda. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also, in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130; Schwarzenberg, *loc. inf. cit.*) Soluble in acids. Decomposed by caustic potash, and by a boiling aqueous solution of ordinary phosphate of soda. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 160.)

Phosphate *of dinoxide* of Mercury.

I.) *di.* Insoluble in water, in phosphoric or tartaric acids, or in aqueous solutions of the salts of dinoxide of mercury. When recently precipitated, it dissolves in an aqueous solution of chloride of ammonium, though less completely than the phosphate of the protoxide. Nitrate of ammonia dissolves it less readily than chloride of ammonium. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.) Decomposed by cold aqueous solutions of caustic potash and ammonia and of carbonate of ammonia. Soluble in nitric acid.
$2\,Hg_2\,O, H\,O, cPO_5$

II.) *tri.* Ppt.
$3\,Hg_2O, cPO_5$

Phosphate *of protoxide* of Mercury. $3\,HgO, cPO_5$ Insoluble in water, or alcohol. Soluble in phosphoric, nitric, and chlorhydric acids, and in many ammonia salts.

When recently precipitated, it dissolves in cold aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.)

*Pyro*Phosphate *of dinoxide* of Mercury & of Soda. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate *of protoxide* of Molybdenum.

I.) *acid.* Deliquescent. Soluble in water, and in an aqueous solution of caustic ammonia. (Berzelius.)

II.) *di.* $2\,MoO; HO, PO_5$ Insoluble in water. Soluble in an aqueous solution of protochloride of molybdenum.

Phosphate *of binoxide* of Molybdenum.

I.) *acid.* Soluble in water, and in ammonia-water. (Bucholz.)

II.) *mono.* MoO_2, HO, PO_5 Sparingly soluble in an aqueous solution of diphosphate of ammonia.

"Phosphate of Molybdenum," *i. e. the yellow precipitate produced by molybdate of ammonia in the solution of a phosphate.* See Molybdic Acid with Phosphate of Ammonia.

Phosphate of Molybdic Acid.

I.) "*basic.*" Insoluble in water.

II.) "*acid.*" Readily soluble in water, and alcohol. (Berzelius.)

Phosphate of Morphine.

I.) *normal.* Readily soluble in chlorhydric acid.

II.) *acid.*

*Meta*Phosphate of Naphtylamin. Sparingly soluble in water, and alcohol.

*c*Phosphate of Naphtylamin. Readily soluble in water, and in boiling alcohol.

*Meta*Phosphate of Nickel.

I.) *Dimetaphosphate?* $2\,NiO, 2\,a''PO_5$ Insoluble in water, and dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 58.) Is not decomposed in the least by boiling aqueous solutions of the alkaline carbonates or sulphides. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 352.)

II.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

III.) *Hexametaphosphate.* Ppt. Soluble in an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

*Pyro*Phosphate of Nickel. $2\,NiO, bPO_5 + 6\,Aq$ Ppt. Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Easily soluble in an aqueous solution of pyrophosphate of soda, and the solution remains clear on being heated, unless the precipitate has been formed from chloride of nickel, in which case the above-mentioned solution becomes cloudy when heated. (H. Rose, *Pogg. Ann.*, 1849, **76.** 19.) Soluble in ammonia-water, sulphurous acid, in an aqueous solution of pyrophosphate of soda, and in the mineral acids. Alcohol does not precipitate it from the ammoniacal solution. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 158.)

Phosphate of Nickel.

I.) *acid.* Soluble in dilute phosphoric acid.

II.) *tri.* $3\,NiO, cPO_5 + 7\,Aq$ Insoluble in water. Soluble in sulphuric, nitric, chlorhydric, and phosphoric acids. (Tupputi, *Ann. de Chim.*, 1811, **78.** 158.)

Soluble in aqueous solutions of the salts of nickel; on heating the solution thus obtained a precipitate is formed which disappears again on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.) When boiled with an aqueous solution of diphosphate of ammonia only a faint trace of it dissolves; the phosphates of potash and soda, under similar circumstances, have no action upon it. (Tupputi, *loc. cit.*, p. 170.)

Decomposed by an aqueous solution of any salt of a sesquioxide, with formation of an insoluble phosphate of the sesquioxide. (Guignet, *C. R.*, **49.** 455.)

*Meta*Phosphate of Nickel & of Soda.

I.) *Dimetaphosphate?* $6\,(NiO, aPO_5); NaO, aPO_5$ Insoluble in water, and dilute acids. Soluble in concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 56.)

*Pyro*Phosphate of Nickel & of Soda. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate of Nicotin. Soluble in water.

Phosphate of *ter*NitroMesidin. $3\left(N\left\{\begin{matrix}C_{18}H_{10}(NO_4)\\ H_2\end{matrix}\right. . HO\right), cPO_5$ Insoluble in water. Soluble in dilute phosphoric acid. Water does not decompose it. (Maule, *J. Ch. Soc.*, **2.** 120.)

Phosphate *of protoxide* of Osmium.

I.) *di.* Difficultly soluble in water. (Berzelius.)
$2\,OsO, HO, PO_5$

II.) ? Soluble in nitric acid.

Phosphate of Palladium. Ppt.

Phosphate of Phenyl. $3\,C_{12}H_5O, cPO_5$ Insoluble in water. Soluble in alcohol, and ether. Insoluble in an aqueous solution of caustic potash, unless this is boiling. (Scrugham, *J. Ch. Soc.*, **7.** 240.)

Phosphate of Phosphoric Oxide. (*Phosphoric Phosphate.*) $4\,P_2O, 3\,PO_5$ When recently precipitated it is completely soluble in water; but after standing for a few hours at the ordinary temperature, or immediately at a temperature of 80°, the solution deposits phosphoric oxide. It is also soluble in alcohol when recently prepared; but is insoluble in ether. (Leverrier.)

Phosphate of Picolin. By boiling with water it is converted into an acid salt. (Unverdorben.)

Phosphate of Platinum & Ammonia $4\,NH_3, Pt_2Cl, HO, PO_5$ (Raewsky's). Nearly insoluble in cold, slightly soluble in hot water. (Raewsky.)

*Meta*Phosphate of Potash.

I.) *Monometaphosphate.* $KO, a'PO_5$ Almost completely insoluble in water. Soluble, however, in dilute and concentrated acids, even in acetic acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 62.) Almost absolutely insoluble in water. (Graham, *Phil. Trans.*, 1833, **123.** 275.) Fleitmann (*Pogg. Ann.*, **78.** 250), speaks of it as being completely insoluble in water, and weak acids.

II.) *Dimetaphosphate.* $2KO, 2a''PO_5$ & $+ 2Aq$ The crystallized salt is soluble in 1.2 pts. of water, either hot or cold. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 250.)

III.) *Hexametaphosphate.* Soluble in water. (Graham.)

*Pyro*Phosphate of Potash.

I.) $2KO, bPO_5 + 3Aq$ Very deliquescent. Soluble in water, from which solution it is precipitated on the addition of alcohol. The aqueous solution may be boiled without the salt being converted into ordinary phosphate. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** pp. 134, 135.)

II.) KO, HO, bPO_5 Quickly deliquesces. Very soluble in water. A syrupy aqueous solution of this salt is precipitated when alcohol is added to the acetic-acid solution of No. I. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 136.)

Phosphate of Potash.

I.) *mono.* $KO, 2HO, cPO_5$ Deliquescent. Easily soluble in water. Insoluble in alcohol.

II.) *di.* $2KO, HO, cPO_5$ Deliquescent. Easily soluble in water, and alcohol. (Schubarth's *Tech.*)

III.) *tri.*

a = crystallized. Permanent. Exceedingly soluble in water. (Graham, *Phil. Trans.*, 1833, **123.** 263.) Insoluble in alcohol.

*DiMeta*Phosphate of Potash & of Soda. $KO, NaO, 2a''PO_5 + 2Aq$ Soluble in 24 pts. of water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 339.)

*Pyro*Phosphate of Potash & of Soda. $KO, NaO, bPO_5 + 12Aq$ Soluble in water. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 140.)

Phosphate of Potash & of Soda. $KO, NaO, HO, cPO_5 + 16Aq$ Soluble in water. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** 396.)

Phosphate of Potash with *bi*Sulphate of Potash. $KO, 2HO, cPO_5; KO, HO, 2SO_3$ Decomposed by water, and alcohol. (Jacquelain.)

Phosphate of Quinine.

I.) $3\,(N_2\}\,C_{40}H_{24}O_4^{\mathrm{vi}}.\,HO), 3HO, 2cPO_5 + 9Aq$ Difficultly soluble in cold water. (Winckler, from *Buchn. Rep.*, (2.) **49.** 1, in *Pharm. Central B.*, 1848, **19.** 311.) Soluble in water. Very readily soluble in water acidulated with phosphoric acid. (Anderson, *J. Ch. Soc.*, **1.** 58.)

II.) *acid.* Easily soluble in water. (Winckler.)

Phosphate of Rhodium.

Phosphate of Ruthenium.

Phosphate of Sanguinarin (or of *Chelerythrin*). Permanent. Easily soluble in water, and dilute spirit; more difficultly soluble in absolute alcohol. Insoluble in ether. The aqueous solution may be kept for a long time without decomposing. (Probst, *Ann. der Pharm.*, 1839, **29.** 121.)

*Meta*Phosphate of Silver.

I.) *Dimetaphosphate.* $2AgO, 2a''PO_5$ Much less soluble than trimetaphosphate of silver. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 252.)

II.) *Trimetaphosphate.* $3AgO, 3a'''PO_5 + 2Aq$ Soluble in 60 pts. of cold water. The permanence of this salt in cold solutions is remarkable; it can even be crystallized from liquors strongly acidulated with nitric acid. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 310, 312.)

III.) *Hexametaphosphate.*
(*Ordinary metaphosphate.*)

a = normal. $6AgO, 6a^{\mathrm{vi}}PO_5$ Completely insoluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 253, 359.) Very easily soluble in an aqueous solution of hexametaphosphate of soda. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 329, 320, 305.) Exceedingly easily decomposed by an aqueous solution of sulphide of sodium. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 359.) Soluble in ammonia-water, and in nitric acid. Also soluble in a large excess of an aqueous solution of hexametaphosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** pp. 3, 5, 6, 7.) Cold water very slowly abstracts a portion of its acid, and if it be immersed in boiling water, while recently precipitated and still moist, it is decomposed, with formation of the salt *b*. (Berzelius, *Pogg. Ann.*, 1830, **19.** 332; H. Rose, *Ibid.*, 1849, **76.** 6.)

b = basic. "$3AgO, 2aPO_5 + Aq$" Insoluble in cold, gradually decomposed by the continued action of boiling water. (Berzelius, *Pogg. Ann.*, **19.** 332.) Soluble in nitric acid. (H. Rose, *Ibid.*, **76.** 7.) Fleitmann & Henneberg, (*Ann. Ch. u. Pharm.*, 1848, **65.** 332) suggest that this salt may be the same as the silver salt of their first acid. *Vid. inf. Anomalous* Phosphate of Silver, after the salt of the ordinary *c* acid.

Metaphosphate of silver is soluble in cold metaphosphate of anilin, the solution being partially decomposed on boiling. (Nicholson.)

*Pyro*Phosphate of Silver.

I.) *di.* $2AgO, bPO_5$ Permanent. Insoluble in water. Is not altered by boiling with water, nor attacked by acetic acid. Easily soluble in nitric and sulphuric acids; on heating these acid solutions it is converted into ordinary (*c*) phosphate of silver. Decomposed by chlorhydric acid. Tolerably easily soluble in ammonia-water. Soluble in an aqueous solution of pyrophosphate of soda(?) with combination. It is not decomposed in the least when boiled with an aqueous solution of pyrophosphate of soda, but is almost instantaneously decomposed when boiled with ordinary (*c*) phosphate of soda, *c* phosphate of silver being formed. When the solution of a silver salt is added to a mixed solution of the *b* and *c* phosphates of soda the ordinary *c* phosphate of silver is precipitated first, i. e. before any pyrophosphate of silver falls. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 109 – 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** pp. 128 – 130.) Soluble in ammonia-water, and nitric acid. Insoluble in aqueous solutions of the pyrophosphates. Very slightly soluble in an aqueous solution of nitrate of silver. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 161.) Not completely insoluble in a very large excess of an aqueous solution of pyrophosphate of soda. (H. Rose, *Pogg. Ann.*, 1849, **76.** 17.)

Phosphate of Silver.

I.) *di.* $2\,\mathrm{Ag\,O, H\,O,}\ c\mathrm{PO_5}$ Permanent. Instantly decomposed by water. (Berzelius; Schwarzenberg.) Insoluble in absolute alcohol, or in ether. Soluble in phosphoric acid. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 162.)

II.) *tri.* $3\,\mathrm{Ag\,O,}\ c\mathrm{PO_5}$ Insoluble, or very sparingly soluble in water. Soluble in nitric acid and in phosphoric acid. (Berzelius, *Gilbert's Ann. Phys.*, 1816, **53.** 409.) Readily soluble in phosphoric, acetic, and nitric acids; also, in ammonia-water, and in an aqueous solution of carbonate of ammonia; less easily soluble in solutions of nitrate, and succinate of ammonia; imperfectly soluble in a solution of sulphate of ammonia.

Soluble in an aqueous solution of chloride of ammonium, and also very imperfectly in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 97, 98.) Readily soluble, with decomposition, in aqueous solutions of the soluble hyposulphites. (Herschel, *Edin. Phil. Journ.*, 1819, **1.** 397.) Soluble in ammonia-water and in nitric acid. (H. Rose, *Tr.*) Insoluble in an aqueous solution of *c* phosphate of soda. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 110, 111.) Insoluble in aqueous solutions of *c* diphosphate of soda or of the silver salts. (H. Rose, *Pogg. Ann.*, 1849, **76.** 24.) Insoluble in neutral liquors; it may be conveniently and completely precipitated from the nitric-acid solution by adding to this a slight excess of carbonate of silver, in order to neutralize it. (Chancel, *C. R.*, **49.** 997.)

When an equivalent of $3\,\mathrm{Ag\,O, PO_5}$ is boiled with an equivalent of $\mathrm{Na\,O, 3\,C\,O_2}$, in aqueous solution, $\frac{44}{1000}$ of it may be decomposed. While, on the other hand, when an equivalent of $\mathrm{Ag\,O, 3\,C\,O_2}$ is boiled with one of $3\,\mathrm{Na\,O, PO_5}$, $\frac{9269}{10000}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3) **51.** 351.) Decomposed by an aqueous solution of any salt of a sesquioxide, with formation of an insoluble phosphate of the sesquioxide. (Guignet, *C. R.*, **49.** 455.) It is not precipitated from solutions which contain citrate of soda. (Spiller.) It is precipitated even in presence of 10000 pts. of water. (Pfaff.)

*Anomalous*Phosphate of Silver.

I.) *Salt of Fleitmann & Henneberg's 1st acid.* "$6\,\mathrm{Ag\,O, 4\,PO_5}$" Ppt. Insoluble in water, but is partially decomposed by long-continued washing with water. Soluble in a very large excess of an aqueous solution of the corresponding soda salt. (F. & H., *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 329, 330, 332.) Fleitmann & Henneberg suggest that this salt may be the same as the basic metaphosphate of silver of Berzelius.

II.) *Salt of Fleitmann & Henneberg's 2d Acid.* "$6\,\mathrm{Ag\,O, 5\,PO_5}$." Ppt. Very easily soluble in an aqueous solution of the corresponding soda salt. (F. & H., *loc. cit.*, p. 333.)

*TriMeta*Phosphate of Silver & of Soda.

$3\,\mathrm{Ag\,O,}\ 3\,a'''\mathrm{PO_5};\ 3\,\mathrm{Na\,O,}\ 3\,a'''\mathrm{PO_5}$ Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 310, 311.)

*Pyro*Phosphate of Silver & of Soda.

a.) Easily soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

b = $6\,(2\,\mathrm{Ag\,O,}\ b\mathrm{PO_5});\ 2\,\mathrm{Na\,O,}\ b\mathrm{PO_5} + 4\,\mathrm{Aq}$ Not completely insoluble in an aqueous solution of pyrophosphate of soda. Easily soluble in nitric acid. (Baer, *Pogg. Ann.*, 1848, **75.** 171.)

*Meta*Phosphate of Soda.

I.) *Monometaphosphate.* *(Strongly heated salt of Graham. Insoluble metaphosphate.)* $\mathrm{Na\,O,}\ a'\mathrm{PO_5}$ Even when reduced to an impalpable powder, it is only very slowly acted upon by continued digestion in a large quantity of boiling water. When it does dissolve, it appears to pass into No. III. (the trimetaphosphate). (Graham, *Phil. Trans.*, 1833, **123.** pp. 273–275.) Dilute acids have no action upon it, but alkalies, by long digestion, withdraw a portion of the phosphoric acid. (Graham, *Ibid.*, p. 276.) Almost completely insoluble in water. Soluble, however, in dilute and concentrated acids, even in acetic acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 63.)

II.) *Dimetaphosphate.* $2\,\mathrm{Na\,O,}\ 2\,a''\mathrm{PO_5}\ \&+4\,\mathrm{Aq}$ The crystallized salt is soluble in 7.2 pts. of water, either hot or cold. Completely insoluble in strong alcohol, and even very dilute spirit only dissolves traces of it. The anhydrous salt greedily absorbs water from the air. It evolves considerable heat when moistened with water. The aqueous solution may be preserved, in the cold, for months without decomposition, and even on boiling it is transformed but slowly to ordinary *c* phosphate. Very easily soluble in concentrated chlorhydric acid, from which it crystallizes again completely as neutral salt, on the addition of spirit. It may also be recovered, as neutral salt, from its solution in caustic soda, when this is evaporated. It is most permanent in alkaline solutions; but on boiling with acids it is rapidly converted to the ordinary *c* phosphate, sulphuric acid acting most quickly and completely. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 247 – 249.)

III.) *Trimetaphosphate.* *(Slightly heated salt of Graham.)* $3\,\mathrm{Na\,O,}\ 3\,a'''\mathrm{PO_5} + \frac{1}{2}\,\mathrm{Aq}\ \&\ 11\frac{1}{2}\,\mathrm{Aq}$ Readily soluble in water. (Graham, *Phil. Trans.*, 1833, **123.** pp. 273, 274.) Soluble in 4.5 pts. of cold water. The aqueous solution may be preserved in the cold for a long time, but on boiling it acquires an acid reaction after a time, and when this has once occurred, further decomposition goes on more rapidly. Insoluble in alcohol, and difficultly soluble even in very dilute spirit. Decomposed to ordinary *c* phosphate by boiling chlorhydric acid. Does not melt in its water of crystallization. It forms with the other trimetaphosphates many double salts, all of which are soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 304 – 309, 316.) Easily soluble in water. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 356.)

IV.) *Tetrametaphosphate.* $4\,\mathrm{Na\,O,}\ 4\,a^{\mathrm{IV}}\mathrm{PO_5} + 8\,\mathrm{Aq}$ Permanent. Soluble in water to a slimy solution; less soluble in spirit. (Fleitmann, *Pogg. Ann.*, 1849, **78.** pp. 354, 355.)

V.) *Hexametaphosphate.* *(Glassy metaphosphate. Graham's metaphosphate. Ordinary metaphosphate. Deliquescent metaphosphate.)* $6\,\mathrm{Na\,O,}\ 6\,a^{\mathrm{VI}}\mathrm{PO_5}$ Deliquescent. Soluble in water. (Proust.) Deliquesces in damp air. Highly soluble in water. The aqueous solution undergoes no alteration when kept for several months. Insoluble in alcohol. (Graham, *Phil. Trans.*, 1833, **123.** pp. 276 – 278.) Spirit precipitates it from the aqueous solution, as a concentrated solution. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 359.)

Compare Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 305, 316.)

*Pyro*PHOSPHATE OF SODA.

I.) *mono* or "*acid.*" Very soluble in water.
$Na O, H O, bPO_5$ (Graham, *Phil. Trans.*, 1833, **123.** 272.) Easily soluble in water. Only slightly soluble in alcohol. It is precipitated from an acetic acid solution of the normal salt (No. II.) on the addition of alcohol. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 139.) Much more soluble in water than mono (*c*) phosphate of soda ($Na O, 2 H O, cPO_5$). (Berzelius's *Lehrb.*, **3.** 230.)

II.) $2 Na O, bPO_5 + 10 Aq$ Permanent. Soluble in water. More difficultly soluble in water than ordinary *c* diphosphate of soda. (Clarke.) The aqueous solution is not changed by boiling, or when kept for a long time. The salt is, however, converted into the ordinary *c* phosphate when heated with sulphuric, chlorhydric, acetic, or even phosphoric acid. The aqueous solution dissolves most of the metallic pyrophosphates, with formation of easily soluble double salts. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, pp. 111, 113; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** pp. 130, 132.) For the stability of aqueous solutions of this salt, see also under pyrophosphoric acid, or H. Rose, *Pogg. Ann.*, 1849, **76.** 20. Pyrophosphate of soda is not sensibly soluble in alcohol. (Persoz, *Ann. Ch. et Phys.*, (3.) **20.** 325.)

PHOSPHATE OF SODA.

I.) *mono.* Very easily soluble in water; not
$Na O, 2 H O, cPO_5 + 2 Aq$ easily soluble in alcohol. (Graham.) Insoluble in alcohol. (Berzelius's *Lehrb.*) This salt is precipitated when alcohol is added to a solution of ordinary phosphate of soda in nitric acid. (Schwarzenberg, *Ann. Ch. u. Phàrm.*, 1818, **65.** 140.)

II.) *di.*

a.) *Containing no water of crystallization.* Soluble in water.
$2 Na O, H O, cPO_5$

In a solution containing for 100 pts. of water, pts. of dry $2 Na O, H O, PO_5$	The boiling-point is elevated.	Difference.
0.0	0.0	
11.0	0.5	11.0
21.0	1.0	10.0
31.0	1.5	10.0
40.8	2.0	9.8
50.3	2.5	9.5
59.4	3.0	9.1
68.1	3.5	8.7
76.4	4.0	8 3
84.2	4.5	7.8
91.5	5.0	7.3
98.4	5.5	6.9
105.0	6.0	6.6
111.4	6.5	6.4
11[2 ?]6	6.6	

The point of ebullition of pure water, observed in a glass-tube containing bits of metallic zinc, having been 99.9°. (Legrand, *Ann. Ch. et Phys.*, 1835, (2.) **59.** 433.)

$b = 2 Na O, H O, cPO_5 + 14 Aq$ Nonefflorescent. This salt is contained in hot solutions of common phosphate of soda, and may be obtained when these are evaporated at temperatures superior to 33°; at lower temperatures the compound *c* crystallizes out. (Clark.)

$c = 2 Na O, H O, cPO_5 + 24 Aq$ Effloresces rapidly.
(Common Phosphate of Soda. Neutral Phosphate of Soda. Pearl Salt.) Soluble in 8.48 pts. of water at 17°; or 100 pts. of water at 17° dissolve 11.8 pts. of it; or the aqueous solution saturated at 17° contains 10.6% of it, or 4.2% of the anhydrous salt, and is of 1.0442 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.) Soluble in 4 pts. of cold and in 2 pts. of boiling water; the saturated cold solution containing 20% of it, and the boiling saturated solution 33.33%. (Pagenstecker.) This salt is much less soluble in water than has been stated by Pagenstecker; the erroneous results of this chemist were probably due to the formation of supersaturated solutions, a phenomenon to which phosphate of soda is peculiarly liable. (H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 331.) Soluble in 4 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht*, *für* 1854, p. 76.) The aqueous solution saturated at 15° is of 1.046912 sp. gr., and contains dissolved in every 100 pts. of water at least 12.735 pts. of it. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) 100 pts. of water at 18.3° dissolve 26.77 pts. of it. [T.] Very soluble in water, but much more soluble in hot than in cold water. (Mitscherlich, *Ann. Ch. et Phys.*, 1821, (2.) **19.** pp. 388, 407.) It melts in its water of crystallization, at a temperature below 100°; and is very liable to form supersaturated solutions like sulphate of soda. (Gay-Lussac.) The saturated aqueous solution boils at 105.5°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90; at 106.6° (Legrand.) Insoluble in alcohol.

An aqueous solution of sp. gr. (at 19°)	Contains (by experiment) $2 Na O, H O, PO_5 + 24 Aq$ (per cent).
1.0442	10.588
1.0292	6.988
1.0220	5.294
1.0198	4.659
1.0160	3 495
1.0114	2.330
1.0067	1.165

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 331.)

From these results Schiff calculates the following table by means of the formula: — $D = 1 + 0.00415 p + 0.00000355 p^2$, — in which D = the sp. gr. of the solution and p the percentage of substance contained in the solution.

An aqueous solution of sp. gr. (at 19°)	Contains	
	Per cent of $2 Na O, H O, PO_5 + 24 Aq.$	Per cent of anhydrous $2 Na O, H O, PO_5$.
1.0041	1	0.397
1.0083	2	0.794
1.0125	3	1.191
1.0166	4	1.588
1.0208	5	1.985
1.0250	6	2.382
1.0292	7	2.779
1.0332	8	3.176
1.0376	9	3.573
1.0418	10	3.970
1.0460	11	4.367
1.0503	12	4 764

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110.** 70.)

III.) *tri.*

a = *anhydrous*
$3 Na O, cPO_5$

b = crystallized. Permanent. 100 pts. of water at 15.56° dissolve 19.6 pts. of it; or 1 pt. of it is soluble in 5.1 pts. of water at 15.56°. It melts in its water of crystallization at 76.67°. (Graham, *Phil. Trans.*, 1833, **123.** pp. 254, 255.) Soluble in 3.94 pts. of water at 15°; or 100 pts. of water at 15° dissolve 28.3 pts. of it; or, the aqueous solution saturated at 15° contains 22.03% of it, or 9.5% of the anhydrous salt, and is of 1.1035 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 350.)

$8\,Na\,O, cPO_5 + 24\,Aq$

An aqueous solution of sp. gr. (at 15°)	Contains (by experiment) per cent of $3\,Na\,O, PO_5 + 24\,Aq.$
1.0193	4.40
1.0393	8.80
1.0495	11.00
1.0812	17.60
1.1035	22.03

From these results Schiff deduces the formula: $D = 1 + 0.004279\,p + 0.00001742\,p^2$, in which D = sp. gr. of the solution and p the percentage of substance in the solution, by means of which Ott has calculated the following table.

An aqueous solution of sp. gr. (at 15°)	Contains	
	Per cent of $3\,Na\,O, PO_5 + 24\,Aq.$	Per cent of $3\,Na\,O,\ PO_5.$
1.0043	1	0.432
1.0086	2	0.864
1.0130	3	1.297
1.0174	4	1.729
1.0218	5	2.161
1.0263	6	2.593
1.0308	7	3.025
1.0353	8	3.458
1.0399	9	3.890
1.0445	10	4.322
1 0492	11	4.754
1.0539	12	5.186
1.0586	13	5.619
1.0633	14	6.051
1.0681	15	6.483
1 0729	16	6.915
1.0778	17	7.347
1.0827	18	7.780
1.0876	19	8.212
1.0925	20	8.644
1.0975	21	9 076
1.1025	22	9.508
1.1076	23	9.941
1.1127	24	10.373

(H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 196.)

*Anomalous*PHOSPHATE OF SODA.

I.) *Salt of Fleitmann & Henneberg's 1st acid.*

a = normal. Soluble in about 2 pts. of cold water. The aqueous solution is exceedingly easily decomposed. Although abundantly soluble in water, as stated above, it dissolves very difficultly and with extreme slowness. Very easily decomposed by acetic acid. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 324–328; compare Laurent & Gerhardt, *Gmelin's Handbook*, **3.** 96.)

"$6\,Na\,O, 4\,P\,O_5 + x\,Aq$"

b = acid. Salt of Fleitmann and Henneberg's 1st acid? (Fleitmann & Henneberg, *loc. cit.*, p. 328.)

"$4\,Na\,O, 2\,H\,O, 4\,PO_5$"

II.) *Salt of Fleitmann and Henneberg's 2d acid.* Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 333.)

"$6\,Na\,O, 5\,PO_5.$"

*TriMeta*PHOSPHATE OF SODA & OF STRONTIA. Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

*Pyro*PHOSPHATE OF SODA & OF STRONTIA. Somewhat soluble in water, and ammonia-water. Insoluble in an aqueous solution of pyrophosphate of soda or in alcohol. Easily soluble in chlorhydric and nitric acids. (Baer, *Pogg. Ann.*, 1848, **75**; pp. 166, 164.)

$9\,(2\,Sr\,O, bPO_5)\,;\ 2\,Na\,O, bPO_5 + 18\,Aq(?)$

*Pyro*PHOSPHATE OF SODA & *of sesquioxide* OF URANIUM. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.) Extremely soluble in water. (Persoz, *Ann. Ch. u. Phys.*, (3.) **20.** 322.)

PHOSPHATE OF SODA & OF URANIUM. Ppt.

$Na\,O, 5\,Ur_2\,O_3, 2\,cPO_5$

PHOSPHATE OF SODA & OF VANADIC ACID. Very slowly soluble in water.

*Pyro*PHOSPHATE OF SODA & OF YTTRIA. Soluble in water. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

*TriMeta*PHOSPHATE OF SODA & OF ZINC. Soluble in water. (Fleitmann & Henneberg, *Ann. Ch. u. Pharm.*, 1848, **65.** pp. 315, 309.)

$Na\,O, 2\,Zn\,O, 3\,a'''PO_5 + x\,Aq$

PHOSPHATE OF SOLANIN.

PHOSPHATE OF STANNETHYL. Insoluble in water.

*Meta*PHOSPHATE OF STRONTIA.

I.) *Dimetaphosphate?* Insoluble in water, and dilute acids. Decomposed by warm concentrated sulphuric acid. (Maddrell, *Ann. Ch. u. Pharm.*, 1847, **61.** 61.) Not decomposed by digestion in solutions of the alkaline carbonates. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 352.)

$Sr\,O, aPO_5$

II.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

*Pyro*PHOSPHATE OF STRONTIA. Somewhat soluble in water. Easily soluble in nitric or chlorhydric acid. Insoluble in acetic acid, or in an aqueous solution of pyrophosphate of soda. (Schwarzenberg, *Ann. Ch. u. Pharm.*, **65.** 144.) Insoluble in an aqueous solution of pyrophosphate of soda, or rather only very slightly soluble therein when recently precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

$2\,Sr\,O, bPO_5 + Aq$

PHOSPHATE OF STRONTIA.

I.) *di.* Permanent. Insoluble in water. Easily soluble in phosphoric, chlorhydric, and nitric acids. (Vauquelin.)

$2\,Sr\,O, H\,O, cPO_5$

Soluble in a boiling aqueous solution of chloride of ammonium, with evolution of ammonia. (Fuchs; Demarçay, *Ann. der Pharm.*, 1834, **11.** 251.) Easily soluble, when recently precipitated, in cold aqueous solutions of chloride of ammonium and nitrate of ammonia, and cannot be completely precipitated therefrom by an excess of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 99, compare p. 334.)

When an equivalent of $2\,Sr\,O, H\,O, P\,O_5$ is boiled with an equivalent of $Na\,O, 2\,C\,O_2$, in aqueous solution, $\frac{24.61}{100}$ of it may be decomposed.

While, on the other hand, when an equivalent of $Sr\,O, 2\,C\,O_2$ is boiled with an equivalent of $2\,Na\,O, H\,O, P\,O_5$ $\frac{45}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 351.) Soluble in aqueous solutions of chloride of ammonium, and of nitrate and succinate of ammonia (Wittstein), and of normal citrate of soda. (Spiller.) Partially decomposed when boiled with an aqueous solution of carbonate of potash or carbonate of soda. (Dulong, *Ann. de Chim.*, **82.** 279.)

Phosphate of Strychnine.

I.) *mono.* Soluble in 5 @ 6 pts. of cold water, and in a much smaller quantity of hot water. (Anderson, *J. Ch. Soc.*, **1.** 56.)

$N_2\left\{C_{42}H_{22}O_4^{VI}\,.\,H\,O, 2\,H\,O, cPO_5 + 4\,Aq\right.$

II.) *di.* Less soluble in water than the monobasic salt. (Anderson, *loc. cit.*)

$2\left(N_2\left\{C_{42}H_{22}O_4^{VI}\,.\,H\,O\right.\right), H\,O, PO_5 + 18\,Aq$

Phosphate of Sulphate of Potash. Decomposed by water, and alcohol. (Jacquelin.)

$K\,O, S\,O_3\,;\,3\,H\,O, PO_5$

Phosphate of Tellurium. Insoluble in water. (Berzelius.)

Phosphate of Thoria. Insoluble in water, or in phosphoric acid. (Berzelius, *Pogg. Ann.*, 1829, **16.** 411.)

$2\,Th\,O, H\,O, cPO_5$

Phosphate *of protoxide* of Tin. Insoluble in water.

$3\,Sn\,O, cPO_5$

Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 98.) Soluble in chlorhydric acid and in an aqueous solution of caustic potash.

Phosphate *of binoxide* of Tin. Insoluble in nitric acid. (Reynoso, *Ann. Ch. et Phys.*, (3.) **34.** 323.) In general it has the same solubility as hydrated metastannic acid. [See *per*Oxide of Tin.] (Fresenius, *Quant.*, p. 161.)

$2\,Sn\,O_2, PO_5 + 10\,Aq$

Phosphate *of binoxide* of Titanium. Insoluble in water. Soluble in phosphoric acid, and in an aqueous solution of chloride of titanium. (Rose.)

Phosphate of Toluidin.

Phosphate *of protoxide* of Uranium. Completely insoluble in water, and is insoluble while yet moist in dilute chlorhydric acid. Very sparingly soluble in concentrated chlorhydric acid, and is reprecipitated therefrom on the addition of water. Decomposed by a solution of caustic potash. (Rammelsberg.)

$2\,Ur\,O, H\,O, cPO_5 + 2\,Aq$

*Pyro*Phosphate *of sesquioxide* of Uranium. Efflorescent. Insoluble in water, alcohol, or ether. Soluble in nitric acid, from which it is reprecipitated on the addition of an alkali. (A. Girard, *C. R.*, 1852, **34.** 24.) Soluble in an aqueous solution of pyrophosphate of soda. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130; A. Girard, *loc. cit.*)

$2\,Ur_2\,O_3, bPO_5 + 5\,Aq$

Phosphate *of sesquioxide* of Uranium.

I.) $Ur_2\,O_3, cPO_5 + 5\,Aq$ Hygroscopic. Partially soluble in water, with separation of a basic salt. (Werther.)

II.) $2\,Ur_2\,O_3, P\,O_5, \& + 4\,Aq\ \&\ 9\,Aq$ Insoluble in water or acetic acid. Easily soluble in the mineral acids. (Arendt & W. Knop.) Insoluble in water. Soluble in a solution of carbonate of ammonia. (Werther.) Is not precipitated from solutions containing citrate of soda. (Spiller.) Soluble in an aqueous solution of carbonate of potash. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 220.)

III.) *acid.* Soluble in water. (Berzelius's *Lehrb.*)

Phosphate *of binoxide* of Vanadium.

I.) *normal.* Quickly deliquescent. Soluble in water. Insoluble in alcohol. After having been ignited it is insoluble in water. (Berzelius's *Lehrb.*, **3.** 1053.)

$V\,O_2, H\,O, cPO_5$

II.) "*basic.*" Not entirely soluble in water. Insoluble in alcohol.

Phosphate *of teroxide* of Vanadium (Vanadic Acid.)

I.) *normal.* Very slowly soluble in water.

$2\,V\,O_3, 3\,H\,O, 3\,cPO_5$

II.) *acid.* Deliquescent. Soluble in water. (Berzelius's *Lehrb.*)

"Phosphate of Vanadic Acid & of Silicic Acid." Tolerably soluble in water. (Berzelius.)

$2\,Si\,O_3, P\,O_5\,;\,2\,V\,O_3, P\,O_5 + 6\,Aq$

*Pyro*Phosphate of Yttria. Soluble in an aqueous solution of pyrophosphate of soda, with combination. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 111; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 130.)

Phosphate of Yttria.

I.) *acid.* Soluble in phosphoric acid. (Gadolin.)

II.) *di.* Insoluble in water. Soluble, with combination, in phosphoric acid. Soluble in chlorhydric, and nitric acids, from which solutions, when saturated, the tri-salt is deposited on boiling. (Berzelius.)

$2\,Y\,O, PO_5$

III.) *tri.* Insoluble in water, or in acids after it has been ignited. Before ignition it is soluble in acids.

$3\,Y\,O, P\,O_5$

*Meta*Phosphate of Zinc.

I.) *Dimetaphosphate.*

a = anhydrous. Unacted upon by acid or alkaline solvents, with the exception of boiling concentrated sulphuric acid. It is not decomposed to any perceptible extent by boiling aqueous solutions of the sulphides of sodium or ammonium; but solutions of the alkaline carbonates abstract its acid. (Fleitmann, *Pogg. Ann.*, 1849, **78.** 350.)

$2\,Zn\,O, 2\,a''PO_5$

b.) crystallized. Insoluble in water. Only difficultly decomposed by boiling acids. (Fleitmann, *loc. cit.*, p. 258.)

$2\,Zn\,O, 2\,a''PO_5 + 8\,Aq$

II.) *Trimetaphosphate.* Appears to be soluble in water. (Fleitmann, cited by H. Rose, *Pogg. Ann.*, 1849, **76.** 9.)

III.) *Hexametaphosphate.* Appears to be soluble in water. (H. Rose, *Pogg. Ann.*, 1849, **76.** 4.)

IV.)? As prepared by burning hyposulphophosphate of zinc, metaphosphate of zinc is soluble in water. (Berzelius.)

*Pyro*Phosphate of Zinc. Soluble in acids, even in sulphurous acid. Also soluble in aqueous

$2\,(2\,Zn\,O, bPO_5) + 3\,Aq$

solutions of caustic potash, and ammonia. From the solution in ammonia-water alcohol precipitates a syrupy mass. (Schwarzenberg, *Ann. Ch. u. Pharm.*, 1848, **65.** 151.) It is not decomposed in the least by a boiling aqueous solution of pyrophosphate of soda, but is immediately decomposed by a boiling solution of ordinary *c* phosphate of soda, *c* phosphate of zinc being precipitated. (Stromeyer, *Gött. gelehrte Anz.*, 1st vol. of the year 1830, p. 110; also in *Schweigger's Journ. für Ch. u. Phys.*, **58.** 129.) Soluble in an aqueous solution of pyrophosphate of soda, and the solution remains clear when boiled. Also soluble in an aqueous solution of sulphate of zinc, but this solution becomes cloudy on being heated, and the precipitate formed does not disappear again on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 19.)

Phosphate of Zinc.

I.) *peracid.* Soluble in water. (Wenzel.)

II.) *mono.* Nearly insoluble in water. (Parrish's *Pharm.*, p. 491.) Soluble in water. (Ure's *Dict.*)
$Zn\,O, 2\,H\,O, c PO_5 + 2\,Aq$

III.) *di.* Insoluble in water. Soluble in phosphoric acid. (Berzelius's *Lehrb.*)
$2\,Zn\,O, H\,O, c PO_5 + 2\,Aq$

IV.) *tri.* Insoluble in water. Soluble in acids, in ammonia-water, and in aqueous solutions of carbonate, sulphate, and nitrate of ammonia, of chloride of ammonium, and of caustic potash.
$3\,Zn\,O, c PO_5$

Soluble in a boiling aqueous solution of chloride of ammonium, with evolution of ammonia. (Fuchs; Demarçay, *Ann. der Pharm.*, 1834, **11.** 251.) When recently precipitated it is soluble in a hot aqueous solution of chloride of ammonium. Somewhat less easily in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.) Easily soluble in aqueous solutions of the salts of zinc. Solutions thus obtained become slightly turbid on heating and not entirely clear again on cooling. (H. Rose, *Pogg. Ann.*, 1849, **76.** 25.)

*Pyro***Phosphate of Zinc & of ZincAmmonium.** Insoluble in water. (Bette.)
$4\,Zn\,O, 2\left(N\left\{H_3\,Zn\right.\right)O, 3\,b PO_5 + 9\,Aq$

Phosphate of Zirconia. Insoluble in water.
$2\,Zr_2\,O_3, 3\,PO_5$

PhosphEthylic Acid. *Vid.* EthylPhosphoric Acid.

Phosphides. All the metallic phosphides are either insoluble in water or immediately decomposed by it. (Persoz, *Chim. Moléc.*, p. 463.)

Phosphide of Aluminum. Decomposed by water. (Deville.)

Phosphide of Antimony.

Phosphide of Barium. Decomposed by water. (Dulong.)

Phosphide of Bismuth.

Phosphide of Cadmium. Soluble, with decomposition, in chlorhydric acid.

Phosphide of Calcium. Permanent in dry air. Decomposed by water and by acids. Unacted upon by concentrated nitric acid, but decomposed by dilute acid. (P. Thénard, *Ann. Ch. et Phys.*, (3.) **14.** 14.)
$Ca_2\,P$

Phosphide of Cerium. Unacted upon by strong acids.

Phosphide of *ter***ChlorAcetyl.** *Vid. ter*ChlorAcetylPhosphin.

*Di***Phosphide of Chromium.** Insoluble in chlorhydric acid; difficultly soluble in nitric acid, and in aqua-regia (H. Rose); insoluble in everything else, even in fluorhydric acid. (Berzelius.)
$Cr_2\,P$

*Tri***Phosphide of Cobalt.** Insoluble in chlorhydric acid. Easily soluble in nitric acid.
$Co_3\,P$

Phosphide of Copper.

I.) *di.*
$Cu_2\,P$

II.) *tri.* Soluble in hot concentrated sulphuric, nitric, and chlorhydric acids.
$Cu_3\,P$

III.) *hexa.* Insoluble in chlorhydric acid; but soluble in nitric acid, and in aqua-regia, with formation of phosphoric acid. (H. Rose.)
$Cu_6\,P$

IV.) $Cu_3\,P_2$

α

β Insoluble in chlorhydric acid. Soluble in nitric and in hot concentrated sulphuric acids. (Berzelius's *Lehrb.*)

V.) $Cu_4\,P$; $Cu_6\,P$

Phosphide of Copper & of Zinc.
$Cu_6\,P$; $Zn_6\,P$

Phosphide of Glucinum. Decomposed by water.

Phosphide of Gold.

Phosphide of Hydrogen. *Vid.* Phosphuretted Hydrogen. [No. I. (solid.)]

Phosphide of Iridium.

Phosphide of Iron.

I.) Unacted upon by chlorhydric or nitric acid. (Hooslef.)
$Fe_2\,P$

II.) $Fe_3\,P_2$ Soluble only in strong nitric acid, or in aqua-regia. (H. Rose.)

III.) $Fe_4\,P$ Same solubility as No. II. (H. Rose.)

IV.) $Fe_6\,P$ Unacted upon by chlorhydric or nitric acid. (Hooslef.)

Phosphide of Lead. Insoluble in water.

Phosphide of Manganese. Insoluble in chlorhydric acid.

Phosphide of Mercury.
$Hg\,P$

Phosphide of Mercury with Sulphate of Mercury. Insoluble in cold water. Soluble in aqua-regia. (H. Rose.)
$P\left\{Hg_3\right. ; 2\,(3\,Hg\,O, 2\,S\,O_3) + 4\,Aq$

Phosphide of Nickel. Insoluble in chlorhydric, soluble in nitric acid.
$Ni_3\,P$

Phosphide of Nitrogen(of Liebig & Wœhler, and of H. Rose). *Vid.* Phospham.

Phosphide of Osmium.

Phosphide of Palladium.

Phosphide of Platinum.

Phosphide of Potassium. Decomposed by water. Unacted upon by petroleum.

Phosphide of Selenium. Phosphorus and selenium may be melted together in all proportions. The compounds $S\,P_2$ and $S\,P_3$ are partially decomposed by water. They are soluble in aqueous solutions of the caustic alkalies, with decomposition. (Berzelius.)

Phosphide of Silver.

Phosphide of Sodium. Decomposed by water. (Dumas, *Tr.*)

Phosphide of Strontium. Decomposed by water. (Dumas, *Tr.*)

Phosphide of Thorium. Unacted upon by water.

Phosphide of Tin.

Phosphide of Titanium.

Phosphide of Yttrium. Decomposed by water. (Wœhler.)

Phosphide of Zinc.

I.) $P Zn$ Unacted upon by hot chlorhydric acid. (Hooslef.)

II.) $Zn_3 P$ Decomposed by chlorhydric acid. (Hooslef.)

Phosphide of zinc is totally insoluble in water. (H. Rose.)

Phosphorous Acid.

a = *anhydrous.* Easily soluble in water.
$P O_3$

b = *hydrated.* Very deliquescent. Soluble in water. The alkaline phosphites are easily soluble in water; most of the other salts are insoluble in water, but soluble in phosphorous acid. All the phosphites are insoluble in alcohol.
$3 H O, P O_3$

Phosphite of Alumina. Sparingly soluble in water. (Berzelius's *Lehrb.*, **3.** 478.)
$2 Al_2 O_3, 3 P O_3$

Phosphite of Ammonia. Deliquescent. Soluble in water. Insoluble in alcohol. (Fourcroy.) 100 pts. of water at 15.5° dissolve 50 pts. of it; more soluble in hot water. (Ure's *Dict.*) Soluble in 2 pts. of cold, and in less hot water. (Berzelius's *Lehrb.*)
$2 N H_4 O, H O, P O_3$

Deliquescent. Very soluble in water. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 210.)

Phosphite of Ammonia & of Magnesia. Only slightly soluble in water. (Fourcroy & Vauquelin.)

Phosphite of Ammonia & of Potash. Difficultly soluble in water. (H. Rose.)

Phosphite of Amyl.

I.) *mono.* *Vid.* AmylPhosphorous Acid.
$C_{10} H_{11} O, 2 H O, P O_3$

II.) *di.* Insoluble in water, or in a weak aqueous solution of carbonate of soda. Soluble in a strong solution of carbonate of soda, and in ether. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** pp. 223, 227.)
(*Amy'Phosphorous Ether.*)
$2 C_{10} H_{11} O, H O, P O_3$

III.) *tri.* Insoluble in water. Soluble in alcohol, and ether. (Railton, *J. Ch. Soc.*, **7.** 219.) Sparingly soluble in water. Soluble in alcohol, and ether. (Williamson & Railton.)
$3 C_{10} H_{11} O, P O_3$

Phosphite of Antimony. Soluble in an excess of chlorhydric acid. (H. Rose.)
$2 Sb O_3, 3 H O, 3 P O_3$

Phosphite of Baryta.

I.) *mono.* Easily soluble in water. (H. Rose.) Decomposed by boiling water to an insoluble basic and an insoluble acid salt. Insoluble in alcohol. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 211.)
$Ba O, 2 H O, P O_3 + Aq$

II.) *di.* Efflorescent. Very slightly soluble in water. Soluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 315.) 100 pts. of water at 15.5° dissolve 0.25 pt. of it. (Ure's *Dict.*) Soluble in phosphorous acid, with combination. (Berzelius's *Lehrb.*) Soluble in dilute chlorhydric acid. (Railton.)
$2 Ba O, H O, P O_3 + Aq$

Phosphite of Baryta & of Ethyl.

I.) $2 Ba O, C_4 H_5 O, P O_3$ Soluble in water, but the solution is decomposed by boiling. (Railton.)

II.) $Ba O, 2 C_4 H_5 O, P O_3$ Very deliquescent. Extremely soluble in water. Soluble in dilute, but only slightly soluble in absolute alcohol. (Railton.)

Phosphite of Bismuth. Insoluble in water.
$2 Bi O_3, 3 PO_3$

Phosphite of Cadmium. Ppt.
$2 Cd O, H O, P O_3$

Phosphite *of sesquioxide* **of Chromium.** Almost insoluble in water. (H. Rose.)
$2 Cr_2 O_3, 3 H O, 3 P O_3$

Phosphite of Cobalt. Difficultly soluble in water. (H. Rose.)
$2 Co O, H O, P O_3$

Phosphite of Copper. Insoluble in water. (H. Rose.)
$2 Cu O, H O, P O_3 + 4 Aq$

Phosphite of Ethyl.

I.) *mono.* *Vid.* EthylPhosphorous Acid.

II.) *di.* *Vid.* *di*EthylPhosphorous Acid.

III.) *tri.* Soluble in water, alcohol, and ether. (Railton, *J. Ch. Soc.*, **7.** 218.)
(*EthylPhosphite of Ethyl.*)
$3 C_4 H_5 O, P O_3$

Phosphite of Glucina. Insoluble in water. (H. Rose.)
$2 Gl_2 O_3, 3 P O_3$

Phosphite *of protoxide* **of Iron.** Almost insoluble in water.
$2 Fe O, H O, P O_3$

Phosphite *of sesquioxide* **of Iron.** Sparingly soluble in cold water. Soluble in a cold aqueous solution of iron-alum. (H. Rose.)
$2 Fe_2 O_3, 3 H O, 3 P O_3$

Phosphite of Lead.

I.) *di.* Insoluble in water. (H. Rose.) Very sparingly soluble in warm phosphoric acid. (A. Wurtz.) Soluble in cold nitric acid, without oxidation. (Berzelius, *Lehrb.*)
$2 Pb O, H O, P O_3$

II.) *tri*, "*tetra.*" Insoluble in water. Soluble in a warm dilute aqueous solution of hypophosphorous acid, from which it is precipitated on neutralizing with ammonia. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **7.** pp. 36, 44.)
$3 Pb O, P O_3 + Aq$

Phosphite of Lime.

I.) *mono*, "*acid.*" Soluble in water. The aqueous solution is decomposed by alcohol, which precipitates normal hypophosphite of lime, while an acid salt remains in solution. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 212.)
$Ca O, 2 H O, P O_3 + Aq$

II.) *di*, "*normal.*" Soluble in water. The aqueous solution is decomposed by boiling to a difficultly soluble basic, and a soluble acid salt. Insoluble in alcohol. (Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 212.) Difficultly soluble in water, the aqueous solution being decomposed by boiling, to an insoluble basic and a soluble acid salt. (Berzelius's *Lehrb.*) Soluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 315.) Soluble in 1 pt. of water at 15.6°. [Y.]
$2 Ca O, H O, P O_3 + Aq$

Phosphite of Magnesia.

I.) *di.* Difficultly soluble in water. (H. Rose.) Requiring 400 pts. of water to dissolve it. (Berzelius, *Lehrb.*, **3.** 443.)
$2 Mg O, H O, P O_3 + 2 Aq$

Phosphite of Manganese.

I.) *di.* $2\,MnO, HO, PO_3 + Aq$ Sparingly soluble in water. Soluble in aqueous solutions of chloride of manganese and sulphate of manganese. (H. Rose.)

Phosphite of Nickel. $2\,NiO, HO, PO_3$ Sparingly soluble in water. (H. Rose.)

Phosphite of Potash.

I.) *di,* "*normal.*" $2\,KO, HO, PO_3$ Very deliquescent. Very soluble in water. Insoluble in alcohol. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 207.) Deliquescent. Soluble in water. Insoluble in alcohol. (Dulong.)

II.) "*acid.*" $2\,KO, 3\,PO_3 + 7\,HO$ Somewhat less soluble in water than the preceding salt. (Wurtz, *loc. cit.*, p. 208.) Soluble in 3 pts. of cold, and in a smaller quantity of hot water. (Fourcroy & Vauquelin.)

Phosphite of Silver. Insoluble in water. [Y.]

Phosphite of Soda.

I.) *di* or "*normal.*" $2\,NaO, HO, PO_3 + 10\,Aq$ Deliquescent. Very soluble in water. (A. Wurtz.) Very soluble in water. Also soluble in absolute alcohol. (H. Rose.)

II.) *acid.* $2\,NaO, 3\,PO_3 + 8\,Aq$ Very deliquescent. Soluble in water. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **16.** 209.) Soluble in 2 pts. of cold, and in about the same quantity of hot water. Sparingly soluble in spirit. (Fourcroy & Vauquelin.)

Phosphite of Strontia. $2\,SrO, HO, PO_3 + Aq$ Difficultly soluble in water. On heating the aqueous solution it is decomposed to a difficultly soluble basic, and an easily soluble acid salt.

Phosphite *of protoxide* of Tin. $2\,SnO, HO, PO_3$ Insoluble in water. Soluble in chlorhydric acid; and the solution thus obtained is one of the most powerful reducing agents known.

Phosphite *of binoxide* of Tin. SnO_2, HO, PO_3 Insoluble in water.

Phosphite of Titanium. Insoluble in water.

Phosphite of Zinc. $2\,ZnO, HO, PO_3 + 5\,Aq$ Difficultly soluble in water. (H. Rose.)

PhosphoGlyceric Acid. $C_6H_9PO_{12} = C_6H_7O_5, 2\,HO, PO_5$ Very soluble in water, and alcohol. (Gobley.) Solutions containing more than 1 pt. of the acid in 10 pts. of water are decomposed by boiling; solutions weaker than this are not thus decomposed. (Gobley.)

Most of the salts of phosphoglyceric acid are readily soluble in water, but insoluble, or only sparingly soluble, in alcohol. (Pelouze.)

PhosphoGlycerate of Baryta. $C_6H_7O_5, (BaO)_2, PO_5$ Soluble in water, from which it is precipitated on the addition of alcohol. (Pelouze.)

PhosphoGlycerate of Lead. $C_6H_7O_5, 2\,PbO, PO_5$ Insoluble in water. (Pelouze.)

PhosphoGlycerate of Lime. $C_6H_7O_5, 2\,CaO, PO_5$ Very soluble in *cold,* but very sparingly soluble in *boiling* water. Alcohol precipitates it from the aqueous solution. (Pelouze; Gobley.)

PhosphoMolybdate of *X*. *Vid.* Molybdate of *X*, with Phosphate of *X*.

PhosphoNitrate of *X*. *Vid.* Nitrate of *X* with Phosphate of *X*.

Phosphor*di*Methyl. Insoluble in water.

(*PhosphorCacodyl. diMethylPhosphorus.*)

$$\left.\begin{matrix}(C_2H_3)_2\\(C_2H_3)_2\end{matrix}\right\}P_2$$

Phosphorus. P There are two allotropic modifications.

I.) *Modif. α.* (*Ordinary white Phosphorus.*) Insoluble in water, but is very slowly decomposed thereby.

Soluble in 320 pts. of cold alcohol of 0.799 sp. gr., and in 240 pts. of the same alcohol when it is warm; from this hot solution ¾ of the phosphorus is deposited on cooling. On the addition of water it is precipitated from the alcoholic solution. (Buchner.) Soluble in 20 pts. of absolute ether at 20°; in 240 pts. of ordinary ether at 20°. (Bucholz.) Soluble in 80 pts. of absolute ether at 15.5°, and in 240 pts. of ordinary ether at 15.5°. The ethereal solution undergoes decomposition in the course of time. (Brugnatelli, *Ann. de Chim.*, **24.** 73. [T.].) Soluble in 0.05 pt. of bisulphide of carbon (Bœttger); in 0.125 pt. (Trommsdorff.) Sulphide of carbon is the best solvent known of ordinary phosphorus. (Pelouze & Fremy.)

When a solution of ordinary phosphorus in bisulphide of carbon is exposed to sunlight it is partially decomposed, and some red phosphorus (modif. *β*) is deposited. (Corenwinder, *Ann. Ch. et Phys.*, (3.) **30.** 248.) Alcohol precipitates it from the bisulphide of carbon solution. (Berzelius.) Sparingly soluble in cold, more soluble in hot benzin. (Mansfield.) Soluble in 14 pts. of hot, less soluble in cold rock-oil (naphtha) from Amiano. (Saussure.) Sparingly soluble in warm essential oils, as oil of turpentine, and in the fatty oils. Soluble in warm oil of turpentine, the solution solidifying on cooling. (Jonas.) Soluble in hot oil of copaiba, separating out again in part as the solution cools. (Gerber.) Soluble in hot oil of caraway. Soluble in oil of mandarin. (Luca.) Slightly soluble in cold, more soluble in hot caoutchin; from the hot solution the greater part of it is deposited on cooling. Abundantly soluble, with evolution of heat, in bichloride of sulphur ($Cl\,S_2$); as the solution cools, much of the phosphorus is deposited; but if one continues to heat the solution, it is decomposed. (Wœhler, *Ann. Ch. u. Pharm.*, **93.** 276.) It is also soluble in protochloride of sulphur. (Thompson.) Soluble in disulphide of phosphorus (P_2S) at 50°; from which it crystallizes out when the solution is cooled to + 30°. Largely soluble in terchloride of phosphorus (PCl_3). Soluble to an almost unlimited extent in hot, less readily soluble in cold sulphoperchloride of phosphorus, of Gladstone (PCl_5S_4), and pentachloride of phosphorus. Tolerably readily soluble in warm, less soluble in cold styrol.

Soluble in anilin, though less so than sulphur; also soluble in leukol (quinolein). (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** pp. 143, 169.) Sparingly soluble in cold creosote. (Reichenbach.) Somewhat soluble in boiling fusel-oil (hydrate of amyl), and does not separate out on cooling. (Pelletan.) Readily soluble in valerianic acid, and in valerate of amyl. Tolerably soluble in hydride of valeryl. (Trautwein.)

Very readily soluble in caprylic alcohol (hydrate of capryl) (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 103); in warm chloride of ethylene (Vogel); in warm sulphocyanide of allyl (essence of mustard = $C_5H_5NS_2$) (Fontanelle); and in mercur(*ic*) methyl. Soluble in chloroform (Liebig), in bromal (Lœwig), in warm chloral (Liebig), in acetic ether (O. Henry), in aldehyde (Liebig), in hot protosulphide of cacodyl, and in alkarsine (oxide of cacodyl). Strong vinegar, of 9° @ 10° B., when boiling, dissolves a considerable quantity of it. (Beudet.) Soluble in chloride of ethyl, in warm chloride of benzoyl ($C_{14}H_5O_2Cl$), and in bichloride of tin; also, in the course of a few days, in liquid (by pressure) cyanogen. (Kemp.) Sparingly soluble in nitrite of ethyl. (Favre.) Sparingly soluble in wood-spirit (Zeise); in lignone, from which it is precipitated on the addition of water (L. Gmelin); and in bromoform. (Lœwig).

Sparingly soluble in acetone, the solution undergoing decomposition gradually at the ordinary temperature, but much more rapidly at temperatures nearly equal to that of the boiling-point of the liquid. (Zeise, *Ann. Ch. et Phys.*, (3.) **6.** 502.) A little more soluble than sulphur in acetone. (Chenevix, *Ann. de Chim.*, 1809, **69.** 50.) Insoluble in nicotin. (Barral.) Appears to be insoluble in coniin. (Blyth.) Soluble, with decomposition, in hot concentrated nitric acid. Also decomposed by boiling aqueous solutions of the caustic alkalies.

II.) *Modif. β.* Permanent. (Schrœtter.) The statement that red phosphorus is permanent is an error, since it absorbs oxygen from the air, and gradually runs down to an acid liquid. (G. Wilson; Personne, *C. R.*, 1857, **45.** 114.) Insoluble in water, alcohol, ether, bisulphide of carbon, perchloride of phosphorus, naphtha, or an aqueous solution of caustic potash. Oil of turpentine and other liquids of high boiling-points dissolve small quantities when heated; but as these solutions cool ordinary phosphorus is deposited. Concentrated sulphuric acid has no action upon it in the cold, but when hot it dissolves it easily, with decomposition. Insoluble in dilute, readily soluble, with decomposition, in concentrated nitric acid.

(*Red Phosphorus. Amorphous Phosphorus.*)

Marvellously easily soluble in nitric acid, either hot or cold, with formation of PO_3 and PO_5, being very much more easily soluble than the ordinary modification of phosphorus. (Personne, *C. R.*, 1857, **45.** 115.)

PHOSPHOVINIC ACID. *Vid.* EthylPhosphoric Acid.

PHOSPHURETTED HYDROGEN.

(*Hydride of Phosphorus.*)
P_2H

I.) *solid.* Insoluble in water, or alcohol. (Leverrier.) The only liquid which dissolves, without decomposing it, is liquid phosphuretted hydrogen. (P. Thénard, *Ann. Ch. et Phys.*, (3.) **14.** 28.) Soluble, with decomposition, in dilute nitric acid at a temperature of 30° @ 40°. (Leverrier.) Instantly decomposed by nitric and sulphuric acids. Also soluble, with decomposition, in an alcoholic solution of caustic potash. It is not acted upon by protochloride of phosphorus, bichloride of tin, or chloride of titanium. (P. Thénard, *Ann. Ch. et Phys.*, (3.) **14.** 8.)

PH_2

II.) *liquid.* Entirely insoluble in water. Alcohol, and oil of turpentine appear to dissolve it, but the solution quickly decomposes. (P. Thénard, *Ann. Ch. et Phys.*, (3.) **14.** 23.)

PH_3

III.) *gaseous.* Boiled water absorbs of the more inflammable gas 0.0179 ($\frac{1}{56}$) of its own volume (Gengembre); 0.0250 ($\frac{1}{40}$) of its volume. (H. Davy.)

"The absorption of this gas by water has been stated variously. In 1799, Raymond found that water absorbs rather less than $\frac{1}{4}$ [= 0.25] of its vol. of this gas; in 1802, Henry rates its absorption at $\frac{1}{47}$ [= 0.1213] only; in 1810, I [Dalton] found it $\frac{1}{27}$ [= 0.037]; in 1812, Davy found it $\frac{1}{8}$ [= 0.125]; in 1816, Thompson found it to be $\frac{1}{47}$ [= 0.0213]; I [Dalton] now estimate it at $\frac{1}{8}$ [= 0.125]. These enormous differences may be partly accounted for by varieties in the gas; and partly from the theory of the absorption not being understood." (Dalton, in his *New System*, **2.** 173.) Water absorbs of the less inflammable gas 0.1250 ($\frac{1}{8}$) of a vol. (H. Davy.)

1 volume of alcohol, of 0.85 sp. gr. absorbs 0.5 vol. of it. (Graham.) 1 vol. of ether absorbs 2 vols. of it. (Graham.) Also soluble in volatile oils. 1 vol. of oil of turpentine absorbs 3.25 vols. of it. (Graham.) Slowly absorbed by an aqueous solution of sulphate of copper and by bromine. (Berthelot.) Concentrated sulphuric acid absorbs it without any immediate decomposition; but the solution kept out of contact with the air decomposes in the course of 24 hours. (Buff.)

PHTALAMIC ACID. Soluble in water, and in dilute chlorhydric acid. (Perkin, *Ann. Ch. u. Pharm.*, **98.** 237.)

(*Phtalamid. Naphthalamid. Isomeric with Isatinic Acid.*)
$C_{16}H_7NO_6 = N\left\{\begin{matrix}C_{16}H_4O_4''\\H_2\end{matrix}\right. \cdot O, HO$

PHTALAMATE OF AMMONIA. Very soluble in water; the aqueous solution being decomposed by long-continued boiling. Easily soluble in alcohol. (Laurent.)

$C_{16}H_6(NH_4)NO_6$

PHTALAMATE OF LEAD. Ppt.

PHTALAMATE OF SILVER. Insoluble in cold, soluble, with decomposition, in hot water. Somewhat soluble in alcohol. (Laurent, *Ann. Ch. et Phys.*, (3.) **23.** 117.)

$C_{16}H_6AgNO_6$

PHTALIC ACID(Anhydrous). Sparingly soluble in cold water. Soluble in boiling water, with formation of the hydrated acid. Very soluble in alcohol, and ether.

(*PhtalicAnhydride. Pyro-Alizaric Acid. Phtalid.*)
$C_{16}H_4O_6$

PHTALIC ACID. Sparingly soluble in cold water. Very soluble in alcohol, and ether. Also soluble, without decomposition, in sulphuric, chlorhydric, and nitric acids.

(*Naphthalic Acid. Alizaric Acid.*)
$C_{16}H_6O_8 = C_{16}H_4O_6, 2HO$

Alizaric acid is very sparingly soluble in cold, but soluble in boiling water, being more readily soluble in water than benzoic acid. Easily soluble in alcohol and in aqueous solutions of the alkalies. Soluble in cold concentrated sulphuric acid. Most of its salts are soluble in water. (Schunk, *Rep. Br. Assoc.*, 1847, p. 140; & 1848, p. 64.)

The alkaline phtalates are readily soluble in water; less soluble in alcohol. The other salts are sparingly soluble, or insoluble.

PHTALATE OF AMMONIA.

I.) *acid.* Very soluble in water. Sparingly soluble in alcohol. (Laurent.)

$C_{16}H_5(NH_4)O_8$

PHTALATE OF BARYTA. Somewhat sparingly soluble in water. (Laurent.)

Phtalate of Ethyl.
$C_{16}H_4(C_4H_5)_2O_8$

Phtalate of Lead. Insoluble in water, or acetic acid. (Schunk, *loc. cit.*)
$C_{16}H_4Pb_2O_8$

Phtalate of Lime. Soluble in water. (Schunk, *loc. cit.*)

Phtalate of Magnesia. Soluble in water.

Phtalate of Potash.

I.) *normal.* Deliquescent. Soluble in water. (Schunk, *loc. cit.*) Very soluble in water. (Laurent.)

Phtalate of Silver. Tolerably soluble in water. (Marignac.) Soluble in boiling, less soluble in cold water. (Schunk, *loc. cit.*)
$C_{16}H_4Ag_2O_8$

Phtalate of Soda.

I.) *normal.* Very readily soluble in water. Soluble in hot, less soluble in cold alcohol.

Phtalate of Zinc. Scarcely at all soluble in cold water.

Phtalamid. *Vid.* Phtalamic Acid.

PhtalAnil. *Vid.* PhenylPhtalimid.

PhtalAnilic Acid. *Vid.* PhenylPhtalamic Acid.

Phtalidin. Tolerably easily soluble in cold water, from which solution it is deposited again after several days. Soluble in all proportions in hot alcohol, and ether. (Dusart, *Ann. Ch. et Phys.*, (3.) **45.** 335.) The salts of phtalidin are soluble in water, and alcohol.
(*Phtalenamin.*)
$C_{16}H_9N = N\left\{\begin{matrix}C_{16}H_8''\\H\end{matrix}\right.$

Phtalimid. Almost insoluble in cold, sparingly soluble in boiling water. Largely soluble in boiling alcohol, and ether. Soluble, with decomposition, in hot concentrated sulphuric acid.
(*Naphthalimid. Phtalylamid. Isomeric with Isatin and CyanoSalicyl.*)
$C_{16}H_5NO_4 = N\left\{\begin{matrix}C_{16}H_4O_4''\\H\end{matrix}\right.$

Phtalimid with Oxide of Silver. Soluble in hot water. Abundantly soluble in boiling alcohol, and ether. Soluble in hot ammonia-water, separating out unchanged as the solution cools.
(*SilverPhtalimid.*)
$C_{16}H_4AgNO_4$

Phtaline *nitrè.* *Vid.* NitroPhtalene.

Phycic Acid(from *Protococcus vulgaris*). Utterly insoluble in water. Easily soluble in alcohol, especially if it is hot; also soluble in ether, acetone, and the fatty and essential oils. Soluble in 15 pts. of boiling absolute alcohol; in concentrated sulphuric acid, from which it is precipitated on the addition of water, and in aqueous solutions of caustic potash and soda, but not ammonia. (Lamy, *Ann. Ch. et Phys.*, (3.) **35.** 131.)

The alkaline salts of phycic acid are soluble in water, and alcohol, especially when these are hot; most of the other salts are insoluble precipitates.

Phycite. *Vid.* ErythroMannite.

Phycoerythrin(Red coloring matter of various *algæ*).

Phycohematin(coloring matter of *Rytiplaea tinctoria*). Easily soluble in water, and in ammonia-water. Insoluble in alcohol, ether, or oils. (Kuetzing.)

Phylloretin. Insoluble in water. Readily soluble in boiling alcohol, and in ether. (Forchammer.)
$C_{40}H_{24}''$

Physalin. Very sparingly soluble in cold, somewhat more soluble in boiling water. Easily soluble in alcohol, and chloroform. Very sparingly soluble in cold ether. Tolerably soluble in ammonia-water. Very sparingly soluble in dilute acids.
$C_{28}H_{16}O_{10} = \left.\begin{matrix}C_{28}H_{15}O_8\\H\end{matrix}\right\}O_2$

PhysetOleic Acid.
$C_{32}H_{30}O_4 = C_{32}H_{29}O_3, HO$

PhysetOleate of Baryta. Soluble in boiling alcohol.
$C_{32}H_{29}BaO_4$

PhysetOleate of Lead. Soluble in ether.

Physodein.
$C_{20}H_9O_{18}$

Physodin. Insoluble in water, and alcohol of 80%, but is soluble in boiling absolute alcohol. Insoluble in ether or acetic acid. Unacted upon by dilute acids. Soluble in concentrated sulphuric acid, and with decomposition in nitric acid. Readily soluble in warm aqueous solutions of caustic ammonia, potash, and carbonate of ammonia. (Gerding.)
$C_{20}H_{10}O_{14}$

Picamar. Very sparingly soluble in water. Very easily soluble in alcohol, ether, acetate of ethyl, wood-spirit, bisulphide of carbon, naphtha, and creosote. Insoluble in eupion. Soluble in aqueous alkaline solutions, with combination. (Reichenbach.) Easily soluble in acetic acid. Soluble in concentrated sulphuric acid. (Reichenbach.)

Picolin. Miscible with water in all proportions, but is separated when the water is saturated with caustic potash or with many alkaline salts. (Anderson.) Readily soluble in alcohol, ether (Unverdorben), and wood-spirit. (Anderson.) It mixes readily with volatile oils (Unverdorben), and with fixed oils (Anderson).
(*Odorin*(of Unverdorben).)
(*Isomeric with Anilin*).
$C_{12}H_7N = N\left\{C_{12}H_7'''\right.$

The salts of picolin are readily soluble in water, being, as a rule, somewhat more soluble than those of anilin; several of them are deliquescent. (Anderson.) They are also easily soluble in cold alcohol. (Unverdorben.)

PicrAcetate of *X*. *Vid.* Acetate of *X* with Picrate of *X*.

Picramic Acid. Almost insoluble in boiling water. (A. Girard.) Difficultly soluble in water. (Wœhler.) Easily soluble in alcohol, and ether (Girard); also soluble, without alteration, in dilute sulphuric and chlorhydric acids. Decomposed by concentrated sulphuric and nitric acids.
(*NitroHæmatic Acid. BiNitroPhenidamic Acid. AmibiNitroPhenylic Acid. Deoxidized Picric Acid. BiNitroPhenoylamic Acid.*)
$C_{12}H_5N_3O_{10} = N\left\{\begin{matrix}C_{12}H_2(NO_4)_2''\\H_2\end{matrix}\right. . O, HO$

Picramate of Ammonia. Soluble in water, and alcohol. Insoluble in ether. (Girard.)
$C_{12}H_4(NH_4)(NO_4)_2NO_2$

Picramate of Baryta. Sparingly soluble in water, and alcohol. (Girard.)
$C_{12}H_4Ba(NO_4)_2NO_2$

Picramate of Copper. Insoluble in water, or alcohol. Soluble in ammonia-water, and in acids. (Girard.)
$C_{12}H_4Cu(NO_4)_2NO_2$

Picramate of Lead. Soluble in water. Insoluble in alcohol. Soluble in ammonia-water, and in acids. (Girard.)

Picramate *of protoxide* of Mercury. Ppt. Soluble in acids. (Girard.)

Picramate of Potash. Tolerably soluble in water. Sparingly soluble in alcohol. (Girard.)
$C_{12}H_4K(NO_4)_2NO_2$

PICRAMATE OF SILVER. Insoluble in cold, decomposed by boiling water. Iusoluble in alcohol. (Girard.)

$C_{12}H_4Ag(NO_4)_2NO_2$

PICRAMID. *Vid. ter*NitrAnilin.

PICRANISIC ACID. *Vid.* Picric Acid.

PICRIC ACID.

(*TerNitroPhenic Acid. TerNitroCarbolic Acid. NitroPhenisic Acid. NitroPicric Acid. Crysolepic Acid. CarbAzotic Acid. Welter's Bitter. Picranisic Acid.*)

$C_{12}H_3N_3O_{14} = C_{12}H_2(NO_4)_3O, HO$

Soluble in	160	pts. of water at	5°
“	86	“	15°
“	81	“	20°
“	77	“	22.5°
“	73	“	26°
“	26	“	77°

(Marchand.)

Easily soluble in alcohol, and ether. (Liebig; Schunk; Cahours.) Soluble, with combination, in hot benzin: at the ordinary temperature pure benzin dissolves 8 @ 10 % of it. (Fritzsche.) Insoluble in cold concentrated sulphuric acid, and but sparingly soluble in cold dilute sulphuric acid. Soluble in warm concentrated sulphuric acid, from which it is precipitated unchanged on the addition of water. (Marchand.) When a saturated cold aqueous solution is mixed with an equal volume of sulphuric acid, the greater part of the picric acid is precipitated.

Readily soluble in concentrated nitric acid, not being decomposed even by boiling fuming acid. (Cahours.) Soluble, without decomposition, in hot nitric and chlorhydric acids, and even in aqua-regia, but appears to be slightly changed after long-continued boiling with the latter or with nitric acid. (Kolbe's *Lehrb.*, **1.** pp. 420, 422.) Sparingly soluble in cold, very abundantly soluble in hot creosote. (Reichenbach.)

There has been a question, whether picranisic acid is identical or only isomeric with picric acid. Quite recently Carey Lea has shown (*Am. J. Sci.*, 1858, (2.) **26.** 380), that these acids are really identical. Cahours, who believed this acid to be isomeric, and not identical with picric acid, says that it is sparingly soluble in cold, very easily soluble in boiling water. Easily soluble in alcohol, and ether. Easily soluble in cold fuming nitric acid, but is decomposed when the solution is boiled. (Cahours, *Ann. Ch. et Phys.*, (3.) **25.** 26.)

Most of the picrates are soluble in water.

PICRATE OF ACONITIN. Insoluble in ammonia-water.

PICRATE OF ALUMINA. Permanent. Soluble in water. (Carey Lea, *Am. J. Sci.*, (2.) **26.** 383.)

PICRATE OF AMMONIA. Tolerably readily soluble in water. Sparingly soluble in alcohol. (Liebig.) Sparingly soluble in water. (Cahours, *loc. cit.*) Very difficultly soluble in cold alkaline solutions. (Carey Lea, *Am. J. Sci.*, (2.) **31.** 75.)

$C_{12}H_2(NH_4)(NO_4)_3O_2$

PICRATE OF ANILIN. Nearly insoluble in cold, and very difficultly soluble in boiling water. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 163.) Soluble in boiling, less soluble in cold alcohol

PICRATE OF ARGENT*bi*AMIN. Readily soluble in hot, sparingly soluble in cold water containing ammonia. (Carey Lea, *Am. J. Sci.*, (2.) **31.** 80.)

(*AmmonioPicrate of Silver.*)

$C_{12}H_2\left(N_2\left\{H_6\,.\,Ag\right.\right)N_3O_{14}$

PICRATE OF ATROPIN.

PICRATE OF BARYTA.

I.) $C_{12}H_2Ba(NO_4)_3O_2+5\,Aq$ Easily soluble in water. (Liebig.) The “picranisate of baryta” is sparingly soluble in cold water. (Cahours, *loc. cit.*)

II.) *basic.* Almost insoluble in water. (Kolbe's *Lehrb.*, **1.** 424.)

$C_{12}HBa_2(NO_4)_3O_2+4\,Aq$?

PICRATE OF BEBERIN. Ppt.

PICRATE OF BENZIN. Immediately decomposes when exposed to the air, but may be preserved in an atmosphere of benzin. Decomposed by water. Soluble, without decomposition, in alcohol, and ether. Soluble in hot, less soluble in cold benzin. (Fritzsche.)

$C_{12}H_2(C_{12}H_6)(NO_4)_3O_2$

PICRATE OF CADMIUM. Efflorescent. Extremely soluble in water. By long-continued boiling the aqueous solution is partially decomposed. (Lea, *Am. J. Sci.*, (2.) **26.** 385.)

PICRATE OF CADMIUM*bi*AMIN & OF CADMIUM-AMMONIUM. Decomposed by pure water. Soluble, without decomposition, in a warm solution of mixed ammonia and chloride of ammonium. (Lea, *Am. J. Sci.*, (2.) **31.** 83.)

(*AmmoniaPicrate of Cadmium.*)

$C_{12}H_2\left(N_2\left\{H_6\,.\,Cd\right.\right)N_3O_{14}\,;\ C_{12}H_2\left(N\left\{\begin{matrix}H_3\\Cd\end{matrix}\right.\right)N_3O_{14}$

PICRATE *of protoxide* OF CHROMIUM. Soluble in water. (Lea.)

PICRATE *of sesquioxide* OF CHROMIUM. Soluble in water. (Lea.)

PICRATE OF CHROMIUMAMIN. Decomposed when heated with a considerable quantity of water, even when this contains much ammonia. (Lea, *Am. J. Sci.*, (2.) **31.** 84.)

(*AmmonioPicrate of Chromium.*)

PICRATE OF CINCHONIN.

PICRATE OF COBALT. Soluble in warm, less soluble in cold water. (Lea.) Soluble in water and in boiling absolute alcohol. (Marchand.)

$C_{12}H_2Co(NO_4)_3O_2+5\,Aq$

PICRATE OF COBALT*bi*AMIN. Nearly insoluble in water, by which it is decomposed, however. It is even difficult to wash it, without decomposition, with solutions of carbonated or caustic ammonia. (Lea, *Am. J. Sci.*, (2.) **31.** pp. 79, 82.)

(*Ammonia-Picrate of Cobalt.*)

$C_{12}H_2\left(N_2\left\{H_6\,.\,Co\right.\right)N_3O_{14}+Aq$

PICRATE *of protoxide* OF COPPER.

I.) *normal.* Efflorescent. Easily soluble in water; also soluble in boiling absolute alcohol.

$C_{12}H_2Cu(NO_4)_3O_2+5\,Aq$

II.) *basic.* Soluble in water. Insoluble in boiling absolute alcohol.

PICRATE OF CUPR(*ic*)*bi*AMIN. Insoluble, or nearly insoluble in water, but is decomposed thereby. May be washed with a strong aqueous solution of carbonate of ammonia, and with dilute ammonia-water. (Lea, *Am. J. Sci.*, (2.) **26.** 385, & **31.** pp. 79, 81.)

(*AmmoniaPicrate of Copper.*)

$C_{12}H_2\left(N_2\left\{H_6\,.\,Cu\right.\right)N_3O_{14}$

PICRATE OF ETHYL. Insoluble in water. Sparingly soluble in cold, more easily soluble in boiling alcohol. (Mitscherlich.)

(*Picric Ether. Phenate of Ethyltrinitré. TriNitroPhenetol.*)

$C_{16}H_7N_3O_{14} = C_{12}H_2(C_4H_5)(NO_4)_3O_2$

Picrate of Ferrousamin? Ppt. Does not appear to dissolve when heated with aqueous solutions of chloride of ammonium or of caustic ammonia, but is decomposed by them. (Lea, *Am. J. Sci.*, (2.) **31.** 86.)
(*AmmoniaPicrate of Protoxide of Iron.*)

Picrate of Glucina. Soluble in water. (Lea, *loc. cit.*, vol. **26.**)

Picrate *of protoxide* **of Iron.** Soluble in water. (Lea.)

Picrate *of sesquioxide* **of Iron.** Soluble in water. (Lea, *loc. cit.*, vol. **26.**)

Picrate of Lead.

I.) *normal.* Tolerably soluble in water (E. Kopp, *Ann. Ch. et Phys.*, (3.) **13.** 235), and in dilute alcohol.
$C_{12} H_2 Pb (N O_4)_3 O_2 + Aq$ & $5 Aq$

II.) *di.* Ppt.
$C_{12} H_2 Pb (N O_4)_3 O_2, Pb O, H O$

III.) *tri.* Nearly insoluble in boiling water. (Marchand.)
$C_{12} H_2 Pb (N O_4)_3 O_2, 2 (Pb O, H O) + Aq$

IV.) *penta.* Ppt.
$C_{12} H_2 Pb (N O_4)_3 O_2, 4 Pb O$

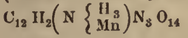
Picrate of Lime. Easily soluble in water. (Liebig.) More soluble in water than the baryta or strontia salt. (Marchand.)
$C_{12} H_2 Ca (N O_4)_3 O_2 + 5 Aq$

Picrate of Lutidin. Less soluble in water than the other salts of lutidin.

Picrate of Magnesia. Very soluble in water, being more soluble than the lime salt. Scarcely at all soluble in boiling alcohol. Very difficultly soluble in cold alkaline solutions. (Carey Lea, *Am. J. Sci.*, (2.) **31.** 75.)
$C_{12} H_2 Mg (N O_4)_3 O_2 + (5 Aq?)$

Picrate of Manganese. Very difficultly soluble in water. (Lea.)
$C_{12} H_2 Mn (N O_{43}) O_2 + 8 Aq$

Picrate of Manganammonium. Very unstable. (Lea, *Am. J. Sci.*, (2.) **31.** 85.)
(*Ammonia Picrate of Manganese.*)


$C_{12} H_2\left(N \left\{\begin{matrix} H_3 \\ Mn \end{matrix}\right.\right) N_3 O_{14}$

Picrate *of dinoxide* **of Mercury.** Very difficultly soluble in cold water, requiring more than 1200 pts. (Liebig.)
$C_{12} H_2 Hg_2 (N O_4)_3 O_2$

Picrate *of protoxide* **of Mercury.** Efflorescent. Easily soluble in water. (Lea.)

Picrate of Methyl. Completely insoluble in water. Tolerably easily soluble in warm, very sparingly soluble in cold alcohol; much more readily soluble in a mixture of equal parts alcohol and ether. Readily soluble in cold ether. Soluble, without alteration, in warm concentrated nitric and sulphuric acids. It separates out from the nitric-acid solution on cooling. Completely insoluble in caustic ammonia, also insoluble in very dilute solutions of potash, though decomposed by stronger solutions. (Cahours, *Ann. Ch. et Phys.*, (3.) **27.** 455.)
(*TerNitrAnisol. Phenate of terNitroMethyl. Isomeric with Chysanisic Acid.*)
$C_{12} H_2 (C_2 H_3) (N O_4)_3 O_2$

Picrate of "Naphthalin." Superficially decomposed by cold water, which removes picric acid, and more freely by boiling water. Warm dilute ammonia-water removes all the picric acid. Soluble in alcohol, ether, and benzin. (Fritzsche.)
$C_{12} H_2 (C_{20} H_9) (N O_4)_3 O_2$

Picrate of Nickel. Efflorescent. Readily soluble in water, and alcohol. (Marchand.)
$C_{12} H_2 Ni (N O_4)_3 O_2 + 5 Aq$ & $8 Aq$

Picrate of Nickelamin. Insoluble in water, but is decomposed by a large quantity of water, even in the cold. (Carey Lea, *Am. J. Sci.*, (2.) **26.** 384.)
(*AmmoniaPicrate of Nickel.*)

Picrate of Nicotin. Ppt.

Picrate of Potash. Soluble in not less than 260 pts. of water at 15° (Liebig); in 14 pts. of boiling water (Chevreul). Sparingly soluble in cold, more readily soluble in hot water. (Cahours.) Insoluble in alcohol. (Liebig.)
$C_{12} H_2 K (N O_4)_3 O_2$

Picrate of Quinine. Very sparingly soluble in water. Readily soluble in alcohol.

Picrate of Quinolein. Resembles in all respects the picrate of anilin. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 174.)

Picrate of Silver. Readily soluble in water. (Liebig.) Only slightly soluble in water. (Lea, *Am. J. Sci.*, (2.) **26.** 386.)
$C_{12} H_2 Ag (N O_4)_3 O_2 + Aq$

Picrate of Soda. Soluble in 10 @ 14 pts. of water at 15°. (Liebig.) Much more soluble in water than the potash salt. (Cahours.) Picrate of soda is the most soluble of all the alkaline picrates, but is nevertheless nearly insoluble in cold, though somewhat soluble in warm aqueous or alcoholic alkaline solutions. (Carey Lea, *Am. J. Sci.*, (2.) **31.** 75.)
$C_{12} H_2 Na (N O_4)_3 O_2$

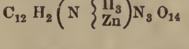
Picrate of Spartein. Permanent. Very sparingly soluble in cold, somewhat more readily, though still very sparingly soluble in boiling water, and alcohol.
$C_{12} H_2\left(N \left\{ C_{14} H_{13}''' . H \right.\right) (N O_4)_3 O_2$

Picrate of Strontia. Easily soluble in cold, and very easily soluble in hot water. Very slowly soluble in boiling absolute alcohol. (Marchand.) The "picranisate" is sparingly soluble in water. (Cahours.)
$C_{12} H_2 Sr (N O_4)_3 O_2 + 5 Aq$

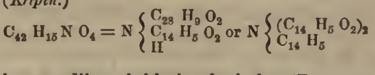
Picrate of Urea. Permanent. Soluble in water. (Lea.)

Picrate of Zinc. Efflorescent. Readily soluble in water, and alcohol. (Marchand.)
$C_{12} H_2 Zn (N O_4)_3 O_2 + 7 Aq$

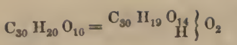
Picrate of Zinc*bi*amin & of Zincammonium. Decomposed by water, but is nearly insoluble therein. It is even difficult to wash it, without decomposition, in solutions of carbonate of ammonia or dilute ammonia-water. Soluble, without decomposition, in a warm aqueous solution of mixed ammonia and chloride of ammonium. (Carey Lea, *Am. J. Sci.*, (2.) **31.** pp. 79, 82, 83.)
(*AmmoniaPicrate of Zinc.*)
$C_{12} H_2 \left(N_2 \left\{ H_6 . Zn \right.\right) N_3 O_{14}$;


$C_{12} H_2 \left(N \left\{\begin{matrix} H_3 \\ Zn \end{matrix}\right.\right) N_3 O_{14}$

Picril. Insoluble in water. Very readily soluble in ether, much less readily soluble in alcohol. (Laurent.)
(*Kripin.*)


$C_{42} H_{15} N O_4 = N \left\{\begin{matrix} C_{28} H_9 O_2 \\ C_{14} H_5 O_2 \\ H \end{matrix}\right.$ or $N \left\{\begin{matrix} (C_{14} H_5 O_2)_2 \\ C_{14} H_5 \end{matrix}\right.$

PicroErythrin. Sparingly soluble in cold,



$C_{30}H_{20}O_{10} = \left.\begin{matrix}C_{30}H_{19}O_{14}\\ H\end{matrix}\right\} O_2$ readily soluble in boiling water. Soluble in alcohol, and ether; in cold aqueous solutions of the caustic alkalies, and in cold concentrated sulphuric acid, the solution undergoing decomposition when heated.

PicroGlaucin(from the root of *Glaucium luteum*). Soluble in water, alcohol, and ether. (Parrish's *Pharm.*, p. 399.)

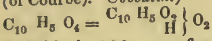
PicroLichenin(from *Variolaria amara*). Permanent. Insoluble in cold, sparingly soluble in boiling water. Readily soluble in alcohol, ether, essential oils, bisulphide of carbon, and in hot, fatty oils. Soluble in concentrated sulphuric acid, and in aqueous solutions of caustic ammonia and potash, and very sparingly in a solution of carbonate of potash.

$C_{24}H_{20}O_{12}$

Picromel. *Vid.* Cholate of Soda.

Picrotoxin(from the seeds of *Menispermum Cocculus*). Permanent.

(*Picrotoxic Acid. Menispermin* (of Courbe). *Cocculin.*)



$C_{10}H_5O_4 = \left.\begin{matrix}C_{10}H_5O_2\\ H\end{matrix}\right\} O_2$

Soluble in 150 pts. of water at 14°.
" 25 " boiling water. (Pelletier & Courbe; Boullay.)
" 180 " boiling water. (Merck.)
" 162 " cold " "
" 54 " boiling " (Duflos.)
" 160 " water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76.)

Soluble in 3 pts. of hot alcohol of 0.81 sp. gr., the solution solidifying on cooling. It is precipitated from the alcoholic solution on the addition of a small quantity of water. (Boullay.) Soluble in 10 pts. of cold, and in 1 pt. of boiling alcohol. (Wittstein's *Handw.*) Difficultly soluble in cold ether. (Merck.) Soluble in 250 pts. of ether of 0.7 sp. gr. (Boullay); in 2.5 pts. of ether. (Wittstein's *Handw.*) It is not extracted from the aqueous solution by ether, nor from the alcoholic solution mixed with caustic potash, but ether abstracts it from the alcoholic solution mixed with chlorhydric acid. (G. Guenkel.) Insoluble in oils, either fixed or volatile. (Boullay.)

Completely soluble in concentrated acetic acid, but requires 2400 pts. of distilled vinegar to dissolve it, and does not dissolve perceptibly in a mixture of equal parts of distilled vinegar and water. (Merck.) Acetic acid facilitates the solution of picrotoxin in water. (Pelletier & Courbe.) Soluble in acetic acid, and in dilute acids generally. (Boullay.) No more soluble in dilute acids than in pure water, excepting acetic acid. (Pelletier & Courbe.) Abundantly soluble in aqueous solutions of caustic potash, soda, and ammonia. (Boullay; Pelletier & Courbe.) Soluble in warm iodic acid, without neutralizing it, and crystallizes out unchanged when the solution is evaporated. (Sérullas, *Ann. Ch. et Phys.*, 1830, (2.) **45.** 276.)

Picrotoxin with Oxide of Lead. Very soluble in water. (Pelletier & Courbe.)

Picryl. *Vid.* Picril.

Pimaric Acid. *Vid.* Resins(of Turpentine).

Pimelic Acid. Soluble in 35 pts. of water at 18°, and very soluble in boiling water. (Laurent.) 100 pts. of water at 18° dissolve 2.56 pts. of it. [= 1 pt. soluble in 39.063 pts. of water.] It is extremely soluble in boiling water, and the solution deposits crystals on cooling; but a solution thus prepared by cooling still contains, at 18°, in 100 pts. 4.32 pts. of the acid. (Wirz, *Ann. Ch. u. Pharm.*, 1857, **104.** 272.) More soluble in water than suberic acid. (Bromeis.) Easily soluble in warm alcohol, and ether; also, without decomposition, in warm concentrated sulphuric acid. (Laurent.)

(*Pimelenic Acid.*)

$C_{14}H_{12}O_8 = C_{14}H_{10}O_6, 2\,H\,O$ & + Aq

Pimelate of Ammonia. Soluble in water, the solution undergoing decomposition after a time when left to itself, or more rapidly when boiled. (Marsh.)

Pimelate of Amyl. Insoluble in water. Soluble in alcohol, and ether. (Marsh.)

$C_{14}H_{10}(C_{10}H_{11})_2O_8$

Pimelate of Baryta. Soluble in water.

$C_{14}H_{10}Ba_2O_8$

Pimelate of Copper. Insoluble in water, or alcohol. (Marsh.)

$C_{14}H_{10}Cu_2O_8$

Pimelate of Ethyl.

I.) *normal.* Insoluble in water.

$C_{14}H_{10}(C_4H_5)_2O_8$

II.) *acid.*

$C_{14}H_{11}(C_4H_5)O_8$

Pimelate *of sesquioxide* **of Iron.** Ppt.

Pimelate of Lead. Ppt. Apparently insoluble in water or alcohol. (Marsh.)

Pimelate of Lime. Soluble in water.

Pimelate of Magnesia. Soluble in water.

Pimelate of Manganese. Soluble in water.

Pimelate *of protoxide* **of Mercury.** Ppt.

Pimelate of Methyl.

$C_{14}H_{10}(C_2H_3)_2O_8$

Pimelate of Silver. Insoluble in water.

$C_{14}H_{10}Ag_2O_8$

Pimelate of Strontia. Soluble in water.

Pimelate of Zinc. Ppt.

Pimelenic Acid. *Vid.* Pimelic Acid.

Pimelin. *Vid.* Hydride of Acryl(Acrolein).

Pinacone.

$a = C_{12}H_{12}O_2$

b = *hydrated.* Readily soluble in water, and still more readily in alcohol, ether, and acetone. Soluble in cold concentrated sulphuric acid. (Stædeler.)

$C_{12}H_{12}O_2 + 2$ Aq & 4 Aq & 14 Aq

Pinic Acid. *Vid.* *a*Resin of Turpentine.

PinicorTannic Acid. After having been dried it dissolves very slowly in water. (Kawalier.)

$C_{32}H_{19}O_{23}$

PiniPicrin. Soluble in water, and alcohol, also in a mixture of alcohol and ether, but is insoluble in pure ether. Decomposed by hot concentrated sulphuric and chlorhydric acids.

$C_{44}H_{36}O_{22} + 4$ Aq

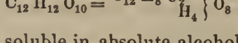
PiniTannic Acid. Readily soluble in water, alcohol, and ether. (Kawalier.)

$C_{14}H_8O_8$

PiniTannate of Lead. Ppt., easily soluble in acetic acid.

Pinite(*Sugar from Pinus Lambertiana*). Extremely soluble in water. Almost insoluble in absolute alcohol; somewhat more soluble in boiling ordinary spirit. Insoluble in chloroform. (Berthelot, *Ann. Ch. et Phys.*, (3.) **46.** 78.) Soluble in water. Very slowly soluble in boiling alcohol. Insoluble in ether. (S. W. Johnson, *Am. J. Sci.*, (2.) **22.** 8.) Abundantly

(*Isomeric with Mannitan and Quercite.*)



$C_{12}H_{12}O_{10} = \left.\begin{matrix}C_{12}H_8O_2^{IV}\\ H_4\end{matrix}\right\} O_8$

soluble in fuming chlorhydric acid, and crystallizes somewhat colored on cooling.

Pinite with Oxide of Lead. At the moment
$\left.\begin{matrix} C_{12}H_8O_2^{IV} \\ Pb_4 \end{matrix}\right\} O_8 + 4\,Aq$
of its formation it is soluble in an excess of cold water; but after having once been formed it is only partially soluble, with decomposition, in boiling water.

Piperic Acid. Almost insoluble in water.
$C_{24}H_{10}O_8 = C_{24}H_9O_7, HO$
Soluble in 275 pts. of absolute alcohol at the ordinary temperature; more soluble in hot alcohol. Sparingly soluble in ether. Scarcely at all soluble in bisulphide of carbon or naphtha; somewhat more easily soluble in benzin. (Babo & E. Keller.)

Piperate of Alumina. Ppt.

Piperate of Ammonia.
$C_{24}H_9(NH_4)O_8$

Piperate of Baryta. Scarcely soluble in
$C_{24}H_9BaO_8$
5000 pts. of cold water, more soluble in hot water.

Piperate of Cadmium.

Piperate of Cobalt. Ppt.

Piperate of Copper(Cu O). Ppt.

Piperate of Ethyl. Insoluble, or but sparingly soluble in water. Soluble in ether.
$C_{28}H_{14}O_8 = C_{24}H_9(C_4H_5)O_8$

Piperate of Iron(Fe O). Insoluble in water.

Piperate of Lead. Ppt.

Piperate of Lime. Somewhat more soluble in water than the baryta salt.

Piperate of Magnesia.

Piperate of Manganese.

Piperate of Mercury. Ppt.

Piperate of Piperidin. Soluble in water.
$C_{34}H_{21}NO_8 = C_{24}H_9\left(N \left\{\begin{matrix} C_{10}H_{10}'' \\ H \end{matrix}\right. . H\right)O_8$

Piperate of Potash. Difficultly soluble
$C_{24}H_9KO_8$
in cold, easily soluble in boiling water. Sparingly soluble in alcohol. Almost insoluble in ether.

Piperate of Silver. Insoluble in water, or
$C_{24}H_9AgO_8$
alcohol.

Piperate of Soda. Sparingly soluble in cold, easily soluble in hot water. Alcohol precipitates it from the aqueous solution.

Piperate of Strontia. Ppt.

Piperate of Zinc. Ppt.

Piperidic Urea. *Vid.* Cyanate of Piperidin.

Piperidin. Soluble in all proportions in water. Soluble in alcohol, and, with combination, in acids. (Cahours, *Ann. Ch. et Phys.*, (3.) **38.** 78.)
(*Piperylamin.*)
$C_{10}H_{11}N = N\left\{\begin{matrix} C_{10}H_{10}'' \\ H \end{matrix}\right.$

Piperin. Permanent. Extremely sparingly soluble in the neutral solvents. Soluble, with combination, in alcohol acidulated with chlorhydric acid. (Bouchardat, *Ann. Ch. et Phys.*, (3.) **9.** 227.) Insoluble, or very sparingly soluble in cold water, but is slightly soluble in hot water, from which it separates out on cooling. (Pelletier; Oersted.) Soluble in 30 pts. of cold, and in 1 pt. of hot alcohol. (Wittstein's *Handw.*) More readily soluble in hot than in cold alcohol, a precipitate being produced in this solution on the addition of water. (Pelletier.) Soluble in 60 pts. of ether (Merck); in 100 pts. of ether. (Wittstein's *Handw.*) Soluble in the essential oils. (Pelletier.) Readily soluble in acetic acid, from which it is precipitated on the addition of water. (Pelletier; Merck.) Abundantly soluble in warm creosote, and remains dissolved when the solution has become cold. (Reichenbach.) Not perceptibly soluble in dilute mineral acids. (Pelletier; Dulong; Regnault.)
(*PiperylPipericylamid.*)
$C_{34}H_{19}NO_8 = N\left\{\begin{matrix} C_{10}H_{10}'' \\ C_{24}H_9O_6 \end{matrix}\right.$

Soluble, in the fatty and essential oils. Insoluble in alkaline solutions. Soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water; also soluble in warm concentrated chlorhydric acid, and, without decomposition, in chloric acid.

Insoluble in water. Easily soluble in hot spirit. Tolerably soluble in ether. (Stenhouse.)

PiperylBenzoylamid. Easily soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **38.** 87.)
(*PiperylBenzamid. BenzoPiperid.*)
$C_{24}H_{15}NO_2 = N\left\{\begin{matrix} C_{10}H_{10}'' \\ C_{14}H_5O_2 \end{matrix}\right.$

PiperylCumylamid. Soluble in alcohol.
(*PiperylCuminamid.*)
$C_{30}H_{21}NO_2 = N\left\{\begin{matrix} C_{10}H_{10}'' \\ C_{20}H_{11}O_2 \end{matrix}\right.$

PiperylSulphoCarbamate of Piperidin. Easily soluble in alcohol, especially when this is warm. (Cahours, *Ann. Ch. et Phys.*, (3.) **38.** 89.)
(*Piperidin with Sulphide of Carbon. SulphoCarbonyldiPiperylbiamic Acid.*)
$C_{22}H_{22}N_2S_4 = N_2\left\{\begin{matrix} C_2S_2'' \\ (C_{10}H_{10}'')_2 . S_2 \\ H_2 \end{matrix}\right.$

PiperylUrea. *Vid.* Cyanate of Piperidin.

Pipitzahoic Acid. Permanent. Almost insoluble in water. Easily soluble in absolute alcohol, and ether; also soluble in spirit, but water precipitates it from its alcoholic solution.
$C_{30}H_{20}O_6 = C_{30}H_{19}O_5, HO$

The alkaline pipitzahoates are easily soluble in water, alcohol, and ether. (Weld, *Ann. Ch. u. Pharm.*, **95.** 188.)

Pipitzahoate of Baryta. Very sparingly soluble in water. Soluble in alcohol. (Weld, *loc. cit.*)

Pipitzahoate of Copper. Insoluble in
$C_{30}H_{19}CuO_6$
water. Soluble in alcohol, and ether. (Weld, *loc. cit.*)

Pipitzahoate of Lead. Soluble in alcohol.
$C_{30}H_{18}Pb_2O_6$

Pipitzahoate of Potash. Soluble in alcohol.

Pipitzahoate of Silver. Insoluble in wa-
$C_{30}H_{19}AgO_8$
ter. Soluble in alcohol, and ether. (Weld, *loc. cit.*)

Pipitzahoate of Soda. Soluble in alcohol.

Pitayin(from *China pitaya* or *pitoya*). Soluble in water, and alcohol. Insoluble in ether.
(*Pitoyin.*)

Pittacal. Permanent. Insoluble in water, alcohol, ether, eupion, or aqueous alkaline solutions. Soluble in dilute sulphuric, and chlorhydric acids. Abundantly soluble in acetic acid. Decomposed by nitric acid. (Reichenbach.)

Pityxylonic Acid. Difficultly soluble in
$C_{25}H_{20}O_8$
cold, easily soluble in boiling water. Easily soluble in alcohol, ether, and aqueous alkaline solutions. (Wittstein.)

Pityxylonate of Lead. Somewhat soluble
$C_{25}H_{20}O_8, PbO$
in water.

"**Platinamin**"(of Gerhardt). *Vid.* Oxide of Platin(*ic*)ammonium.

Platinic Acid. *Vid. bin*Oxide of Platinum.

Platinate of Baryta. Ppt.

Platinate of Potash. There are two compounds, one of which is soluble in water, while the other is insoluble in water and difficultly soluble in strong chlorhydric acid. (Tennant; Berzelius.)

Platinate of Soda. $Na O, 3 Pt O_2 + 6 Aq$ Soluble in oxalic acid, and in dilute nitric acid. Dilute oxygen acids dissolve out the soda. (Weiss & Dœbereiner.)

Platinate of Strontia.

Platinicum. $pt = Pt''$ Platinum as it exists in the platin*ic* compounds.

Platinous Acid. *Vid. prot*Oxide of Platinum.

Platinite of Potash.

Platinite of Soda. Before drying it is soluble in nitric acid. (Vauquelin.)

PlatinoCyanhydric Acid. $H Cy Pt Cy + 5 Aq$ Deliquescent. Very soluble in water, absolute alcohol, and ether. (Dœbereiner.)

PlatinoCyanide of *X*. } *Vid.* Cyanide of *X*,
PlatiniCyanide of *X*. } with *proto*Cyanide of Platinum.

Platino*sesqui*Cyanhydric Acid. The platinosesquicyanhydrates are all soluble in water, and alcohol.

Platino*sesqui*Cyanide of Ammonium. $(N H_4)_2 Pt_2 Cy_5 + 5 Aq$ More soluble than the potassium salt in water. (Weselsky.)

Platino*sesqui*Cyanide of Lithium. $Li_2 Pt_2 Cy_5 + 6 Aq$ More soluble than the ammonium salt in water, and alcohol. (Weselsky.)

Platino*sesqui*Cyanide of Magnesium. $Mg_2 Pt_2 Cy_5 + 14 Aq$ Soluble in water. (Weselsky.)

Platino*sesqui*Cyanide of Potassium. (Same as Knop's "$2 K Cy, Pt_2 Cy_3$." $K_2 Pt_2 Cy_5 + 6 Aq$ Easily soluble in water. (Weselsky.) Easily soluble in water. Insoluble in alcohol. (Knop, in *Berzelius's Lehrb.*)

PlatinoPlatiniCyanide of Aluminum. Deliquescent. Soluble in water, and alcohol.

PlatinoPlatiniCyanide of Ammonium. $C_{22} N_{11} (N H_4)_6 Pt_5 = N H_4 Cy, 5 (N H_4, Pt Cy_2)$ Very soluble in water. Soluble in alcohol.

PlatinoPlatiniCyanide of Barium. $C_{22} N_{11} Ba_6 Pt_5 = Ba Cy, 5 (Ba, Pt Cy_2)$ Soluble in 33 pts. of water at 16°, and more readily in hot water. (Quadrat.)

PlatinoPlatiniCyanide of Calcium. $C_{22} N_{11} Ca_6 Pt_5$ Easily soluble in water.

PlatinoPlatiniCyanide of Copper. $C_{22} N_{11} Cu_6 Pt_5$ Insoluble in water, or in concentrated chlorhydric or dilute nitric acid. Soluble in ammonia-water. (Quadrat.)

PlatinoPlatiniCyanide of Iron. Ppt. $C_{22} N_{11} Fe_6 Pt_5$

PlatinoPlatiniCyanide of Lead. $C_{22} N_{11} Pb_6 Pt_5$ Somewhat soluble in boiling water. (Quadrat.)

PlatinoPlatiniCyanide of Magnesium. $C_{22} N_{11} Mg_6 Pt_5$ Soluble in 3.4 pts. of water at 16°. Soluble in alcohol, and ether. (Quadrat.)

PlatinoPlatiniCyanide of Potassium. $C_{22} N_{11} K_6 Pt_5 + 21 Aq$ Efflorescent. Soluble in 3 pts. of water at 16°, and in much less boiling water; less soluble in alcohol, and ether. (Quadrat.)

PlatinoPlatiniCyanide of Sodium. $C_{22} N_{11} Na_6 Pt_5$ Soluble in water. (Quadrat.)

PlatinoPlatiniCyanide of Strontium. Soluble in water. (Quadrat.)

PlatinoPyridin.
$N \left\{ \begin{matrix} C_{10} H_5''' \\ Pt \end{matrix} \right.$ or $N \left\} C_{10} H_3 pt_2''' \right.$

Platino*bi*SulphoCyanhydric Acid. (*Hydro Platinobi Sulpho Cyanic Acid.*) Soluble in water. By evaporation, the solution is quickly decomposed. (Buckton, *J. Ch. Soc.*, 7. 35.)

Platino*bi*SulphoCyanide of *di*Platosammonium. $N_2 \left\{ \begin{matrix} Pt \\ H_5 \end{matrix} \right. . H, Pt 2 Cy S_2$ Insoluble in water or alcohol. Rather freely soluble in dilute chlorhydric acid. (Buckton, *J. Ch. Soc.*, 7. 39.)

Platino*bi*SulphoCyanide of Copper. Ppt.

Platino*bi*SulphoCyanide of Lead.
I.) *basic.* Ppt. Readily soluble in acetic and other acids.

Platino*bi*SulphoCyanide of Potassium. $K Pt 2 (Cy S_2)$ Permanent. Readily soluble in 2.5 pts. of water at 15.5°, and still more readily soluble at higher temperatures. Soluble to any extent in warm alcohol. (Buckton, *loc. cit.*, p. 32.)

Platino*bi*SulphoCyanide of Silver. $Ag, Pt 2 (Cy S_2)$ Soluble in an aqueous solution of sulphocyanide of potassium; this solution undergoes decomposition when diluted with water. Partially soluble, with decomposition, in ammonia-water. (Buckton, *loc. cit.*)

Platino*ter*SulphoCyanhydric Acid. (*HydroPlatino ter Sulpho Cyanic Acid.*) Soluble in alcohol, and water. The solution is decomposed when evaporated upon a water-bath. (Buckton, *J. Ch. Soc.*, 7. 30.)

Platino*ter*SulphoCyanide of Ammonium. $N H_4, Pt 3 (Cy S_2)$ Soluble in water, and alcohol. (Buckton, *loc. cit.*)

Platino*ter*SulphoCyanide of Barium. Soluble in water, and in hot alcohol. (Buckton, *loc. cit.*)

Platino*ter*SulphoCyanide of Copper. Insoluble in water. Soluble in ammonia-water. (Buckton, *loc. cit.*)

Platino*ter*SulphoCyanide of Iron. $Fe, Pt 3 (Cy S_2)$ Insoluble in water, or alcohol. (Buckton, *loc. cit.*) Unacted upon by dilute sulphuric, chlorhydric, or nitric acids. Decomposed by strong nitric acid.

Platino*ter*SulphoCyanide of Lead.
I.) *normal.* Soluble in alcohol, less soluble in cold water. Decomposed by hot water.

II.) *basic.* $Pb, Pt 3 (Cy S_2); Pb O$ Insoluble in water or alcohol. Readily soluble in acetic and nitric acids. (Buckton, *loc. cit.*, p. 30.)

Platino*ter*SulphoCyanide of Mercury $Hg_2, Pt 3 (Cy S_2)$ (Hg_2). Insoluble, or nearly insoluble in water. (Buckton, *loc. cit.*)

Platino*ter*SulphoCyanide of Potassium. $K, Pt\,3\,(Cy\,S_2)$ Permanent. Soluble in 12 pts. of water at 15.5°; far more soluble in boiling water; and still more soluble in hot alcohol. (Buckton, *loc. cit.*, p. 23.)

Platino*ter*SulphoCyanide of Silver. $Ag, Pt\,3\,(Cy\,S_2)$ Insoluble in water, or in an aqueous solution of platinotersulphocyanide of potassium. Soluble in cold ammonia-water, but decomposes when the solution is heated. (Buckton, *loc. cit.*, p. 28.) Soluble in sulphocyanide of potassium.

Platino*ter*SulphoCyanide of Sodium. $Na, Pt\,3\,(Cy\,S_2)$ Soluble in water, and alcohol.

Platinosum. $Pt = Pt'$ Platinum as it exists in platinous compounds.

PlatinResin(of Zeise). Mixture of several compounds; for its behavior with solvents, see *Ann. Ch. u. Pharm.*, 1840, **33.** 66 *et seq.*

Platinum. Pt Unacted upon by water, or by sulphuric, chlorhydric, or other simple acids, even when these are concentrated and boiling. When pure it is not attacked by nitric acid, but when alloyed with metals it is generally somewhat soluble therein. Much less readily soluble than gold in aqua-regia. Soluble in chlorine-water.

A mixture of chlorhydric and nitric acids, so long as these acids are not sufficiently concentrated, or the temperature is so low that they cannot react upon each other, has no action upon platinum, nor does the addition of chlorine to the mixture occasion any action upon the metal, but if a few drops of a solution of nitrite of potash, or some nitrous acid be added, the action begins. (Millon, *Ann. Ch. et Phys.*, (3.) **6.** 102.) Completely, though difficultly, soluble in aqua-regia. (Claus, *Beiträge*, p. 37.) Platinum dissolves in the course of time in iodhydric acid, but no sensible quantity of hydrogen is disengaged. (H. Deville, *C. R.*, 1856, **42.** 896.)

Platinum & Silver(alloy). Hot sulphuric acid dissolves out the silver without acting upon the platinum. Nitric acid dissolves some platinum with the silver. (D'Arcet.)

Platosamin compounds. *Vid.* Compounds of Platin(*ous*)ammonium.
(*Base of the 2d series of Reiset's salts.*)
$N \left\{ \begin{matrix} H_3 \\ Pt' \end{matrix} \right.$

*Di*Platosamin compounds. *Vid.* Compounds of Platin(*ous*)*di*amin.
(*Base of the 1st series of Reiset's salts.*)
$N_2 \left\{ \begin{matrix} H_5 \\ Pt' \end{matrix} \right.$

PlatosoPyridin.
$N \left\{ C_{10}\,H_4\,Pt''' \right.$

Plumbagin(from *Plumbago Europæa*). Scarcely at all soluble in cold, much more soluble in boiling water. Readily soluble in alcohol, and ether. Soluble in cold concentrated sulphuric and nitric acids, from which solutions it is precipitated on the addition of water.

Plumbic Acid. *Vid. per*Oxide of Lead(PbO_2).

Plumbate of Baryta. Insoluble in water. (Fremy, *loc. cit.*)

Plumbate of Lead. (*Red Lead. Minium.*) *Vid. Sesqui*Oxide of Lead.

Plumbate of Lime. Insoluble in water. (Fremy, *loc. cit.*) Permanent. Insoluble in water. When treated with nitric acid the lime is dissolved out. (Crum.)

Plumbate of Potash. $K\,O, Pb\,O_2 + 3\,Aq$ Very deliquescent. Decomposed by pure water, but is soluble, without decomposition, in alkaline liquors. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 490.) When the clear solution is diluted with much water it suffers decomposition, $Pb\,O_2$ being precipitated. (Berzelius's *Lehrb.*)

Plumbate of Soda. Decomposed by pure water; sparingly soluble in alkaline liquors. (Fremy, *loc. cit.*)

Plumb*di*Ethyl. $C_8\,H_{10}\,Pb = Pb\,(C_4\,H_5)_2$ Insoluble in water. Soluble in ether. (Buckton.) Soluble in alcohol.

*Di*Plumb*tri*Ethyl. $C_{12}\,H_{15}\,Pb_2 = Pb_2\,(C_4\,H_5)_3$ Insoluble in water. Very easily soluble in alcohol, and ether.

Plumbide of Ethyl. *Vid.* PlumbEthyl.

Plumbide of Iron.

Plumbide of Sodium. Slowly decomposed by water.

Plumbous Acid. *Vid. prot*Oxide of Lead.

Plumbite of Ammonia.

Plumbite of Baryta. Almost insoluble in water. (Dumas, *Tr.*)

Plumbite of Lime. Slightly soluble in water. (Karsten.)

Plumbite of Nickel? Exceedingly difficultly soluble in nitric acid. Readily soluble in chlorhydric acid. (Tupputi, *Ann. de Chim.*, 1811, **78.** 143.)

Plumbite of Potash. Soluble in water. (Dumas, *Tr.*)

Plumbite of Soda. Soluble in water. (Dumas, *Tr.*)

Plumbite of Strontia. Almost insoluble in water. (Dumas, *Tr.*)

Pneumic Acid. Identical with Taurin, *q. v.*

Polein. *Vid.* Melam.

Polychroit. *Vid.* Safranin.

Polychrest Salt. *Vid.* Sulphate of Potash.

Polychromatic Acid. *Vid.* Chrysammic Acid.

Polygalic Acid. *Vid.* Saponin.

Populin. (*BenzoylSalicin.*) $C_{40}\,H_{22}\,O_{16} + 4\,Aq$ Soluble in 1896 pts. of water at 9°; more readily soluble in hot water, and in alcohol. Scarcely at all soluble in ether. Unacted on by cold, decomposed by boiling nitric acid. Soluble in cold dilute chlorhydric acid, but the solution is decomposed by boiling. Soluble, with decomposition, in aqueous solutions of the caustic alkalies and alkaline earths. (Piria, *Ann. Ch. u. Pharm.*, **96.** 375.) Soluble in about 2000 pts. of cold, and in 70 pts. of boiling water. (Braconnot.) Less soluble in a cold saturated solution of chloride of sodium than in pure water.

Soluble in 100 pts. of absolute alcohol at 14° @ 15°. (Biot & Pasteur.) Much more abundantly soluble in boiling alcohol than in boiling water. Scarcely at all soluble in ether. Easily soluble in cold concentrated acetic acid, from which it is partially reprecipitated on the addition of water, and completely by alkalies. (Braconnot.) Easily soluble, without decomposition, in cold acids, not too concentrated, being partially precipitated therefrom by water, and completely by alkalies. (Braconnot; Koninck.) Soluble in aqueous alkaline solutions. (Koninck.)

Populin with Oxide of Lead. Insoluble in water. (Koninck.)

Porphyric Acid. Sparingly soluble in pure water; insoluble in acidulated water. Insoluble in cold, somewhat soluble in boiling alcohol.
$C_{20}H_4N_2O_{14} = C_{20}H_3(NO_4)_2O_5, HO$

Porphyrate of Ammonia.

I.) *normal.* Very sparingly soluble in pure water. Insoluble in an aqueous solution of carbonate of ammonia.
$C_{20}H_3(NH_4)(NO_4)_2O_6$

II.) *acid.* Somewhat soluble in boiling, less soluble in cold water.

Porphyrate of Baryta. Sparingly soluble in water.

Porphyrate of Copper. Ppt.

Porphyrate of Lead. Sparingly soluble in water.

Porphyrate of Lime. Sparingly soluble in water.

Porphyrate of Silver.

Porphyroxin (from *Bengal Opium*). Easily soluble in spirit, ether, and dilute acids. (Merck, *Ann. der Pharm.*, 1837, **21.** 204.)

Potash.
Potassa. } *Vid. prot*Oxide of Potassium.

Potassamid. Gradually deliquesces, with decomposition. Decomposed by water, with evolution of heat, also decomposed by alcohol. Insoluble in and unacted upon by dry petroleum.
$N\left\{\begin{matrix}H_2\\K\end{matrix}\right.$

*Tri*Potassamid. *Vid.* Nitride of Potassium.

Potassium. Decomposes water, alcohol, ether, and as a rule, all liquids which contain oxygen. Insoluble in and unacted upon by dry naphtha, petroleum, and similar hydrocarbons.
K

As a rule, the compounds of potassium are less soluble than those of ammonium (Dumas); but all of its salts are soluble in water, and most of them are readily soluble.

Pourprit (of Batilliat). (Blackish red coloring matter in the sediment of old wines). Insoluble in water. Soluble in concentrated sulphuric acid, and is precipitated therefrom on the addition of water. Soluble in 150 pts. of alcohol, of 80%; less soluble in stronger alcohol. Quite insoluble in ether. (Batilliat, *Traité sur les Vins de la France.*)

Primulin (from *Primula veris*). Easily soluble in water. Also soluble in alcohol, but the less readily in proportion as this is stronger. Insoluble in ether. (Huenefeld.)

Propionamid.
(*Metacetamid. Nitride of Propianyl.*)
$C_6H_7NO_2 = N\left\{\begin{matrix}C_6H_5O_2\\H_2\end{matrix}\right.$

Propionamic Acid. Identical with Alanin, *q. v.*

Propione. Insoluble in water. Soluble in all proportions in alcohol, and ether. (Morley, *J. Ch. Soc.*, **4.** 5.)
(*Ethylide of Propianyl.*)
$C_{10}H_{10}O_2 = \left.\begin{matrix}C_6H_5O_2\\C_4H_5\end{matrix}\right\}$

Propionic Acid (Anhydrous). Insoluble in water. (Limpricht & v. Uslar, *Ann. Ch. u. Pharm.*, **94.** 322.)
(*Propionic Anhydride.*)
$C_{12}H_{10}O_6 = \left.\begin{matrix}C_6H_5O_3\\C_6H_5O_3\end{matrix}\right\}$

Propionic Acid. Soluble in all proportions in water. (Redtenbacher.) Soluble in alcohol, and ether. (Nicklès.)
(*MetAcetonic Aaid. MetAcetic Acid.*)
$C_6H_6O_4 = C_6H_5O_3, HO$

Most of the salts of propionic acid are soluble in water.

Propionate of Ammonia.

Propionate of Amyl. Sparingly soluble in water. Soluble in alcohol, in all proportions, and in ether. (Wrightson, *Phil. Mag.*, (4.) **6.** 98.)
$C_6H_5(C_{10}H_{11})O_4$

Propionate of Baryta. Very easily soluble in water, especially when this is hot. (Bœhme.) Soluble in 1.3 pts. of water at 16°. Almost insoluble in absolute alcohol. (Strecker, *Ann. Ch. u. Pharm.*, **92.** 87.)
$C_6H_5BaO_4 + Aq$

Propionate of BromAllyl. Insoluble in water. Soluble in ether. (Berthelot & De Luca, *Ann. Ch. et Phys.*, (3.) **48.** 304.)
(*Hemibromhydrin.*)
$C_{12}H_9BrO_4 = C_6H_5(C_6H_4Br)O_4$

Propionate of Copper. Easily soluble in water. (Wrightson, *Phil. Mag.*, (4.) **6.** 98.)
$C_6H_5CuO_4 + Aq$

Propionate of Ethyl. Insoluble in water.
$C_6H_5(C_4H_5)O_4$

Propionate of Lead.

I.) *normal.* Deliquesces in damp air. Soluble in water. (Strecker, *Ann. Ch. u. Pharm.*, **92.** 89.)
$C_6H_5PbO_4$

II.) *basic.* Soluble in water, and alcohol. (Frankland & Kolbe.) Somewhat soluble in water. (Strecker, *loc. cit.*)
$C_6H_5PbO_4; PbO$

Propionate of Lime. Apparently efflorescent. (Strecker.) Permanent. (Wrightson, *Ann. Ch. u. Pharm.*, **90.** 44.) Readily soluble in water. Sparingly soluble in alcohol. (Strecker, *Ann. Ch. u. Pharm.*, **92.** 88.)
$C_6H_5CaO_4 + Aq$

Propionate of Magnesia. Soluble in water. (Strecker.)

Propionate of Potash. Deliquescent. Soluble in water. Less soluble in absolute alcohol, and still less soluble in ether. (Strecker, *Ann. Ch. u. Pharm.*, **92.** 86.)
$C_6H_5KO_4$

Propionate of Silver. Soluble in boiling water, but less soluble in water than the acetate of silver. (Frankland & Kolbe.)
$C_6H_5AgO_4$

Propionate of Soda. Deliquescent. Very soluble in water. (Dumas.)
$C_6H_5NaO_4 + 2\,Aq$

Propionic Alcohol. *Vid.* Hydrate of Propyl.

Propionic Aldehyde. *Vid.* Hydride of Propionyl.

PropionSulphuric Acid. *Vid.* SulphoPropionic Acid.

Propyl.
(*Trityl*(of Gerhardt).)
$C_6H_7 \text{ or } \left.\begin{matrix}C_6H_7\\C_6H_7\end{matrix}\right\}$

Propylal. Miscible with water, alcohol, and ether. (Limpricht, *Ann. Ch. u. Pharm.*, **94.** 326.)
(*Isomeric with Acetone, Propylic Aldehyde, and Allylalcohol.*)
$C_6H_5O_2$

PropylAlcohol. *Vid.* Hydrate of Propyl.

Propylamin. Readily soluble in water. (Berthelot & De Luca.) Soluble in water. Most of its salts are soluble in water, and alcohol. (Parrish's *Pharm.*, p. 418.)
(*Tritylamin. MetAcetamin. Ocnylamin. TritylAmmonium. Secalin.*)
$C_6 H_9 N = N H_2 (C_6 H_7)$

Propylene.
(*Metacene. Tritylene. Isomeric with Hydride of Allyl.*)
$C_6 H_6''$

Nature of the Gas experimented upon.

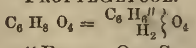
Name of solvent used.	Pure propylene prepared from IodoPropylene ($C_6 H_5 I$). 1 vol. of the solvent absorbs gas.	Containing 2 % of air, from IodoPropylene. 1 vol. of the solvent absorbs gas.	Containing 7 % of air, prepared from Glycerin. 1 vol. of the solvent absorbs gas.	Containing 55 % of air, prepared from Glycerin. 1 vol. of the solvent absorbs gas.	Observations.
Water		$\frac{1}{16}$ to $\frac{1}{10}$ vol.			If a saturated aqueous solution of sulphate of soda be added to this solution, nothing is disengaged except on boiling, when the gas is evolved.
Ordinary alcohol		6 vols.			
Absolute alcohol	12 to 13 vols.		7 vols.		On the addition of water, $\frac{4}{5}$ of the gas is disengaged.
Amyl alcohol		8 vols.			Disengaged by ebullition.
Oleine		8 to 10 vols.			Disengaged on heating.
Acetic acid (glacial)		about 6 vols.			When 1 vol. water is added, $\frac{1}{3}$ of the gas is disengaged.
Oil of turpentine	18 vols.	15 vols.	16 vols.	4 vols.	
*Di*chloride of copper, dissolved in chlorhydric acid		about 3 vols.	2 vols.	1 vol.	Disengaged by ebullition. Less soluble than ethylene in this menstruum.
Ether	17 vols.	16 vols.	13 to 14 vols.	5 vols.	Partially disengaged when the solution is mixed with much water.
Sulphide of carbon	more than 13 vols.	8 to 12 vols.	about 10 vols.		
Chloroform (of commerce)		17 vols.	18 vols.		
Benzin (crystallizable)		more than 13 vols.			

Very little is absorbed by syrupy phosphoric acid. It is entirely absorbed by concentrated sulphuric acid, also by fuming sulphuric acid. At ordinary temperatures it is slowly absorbed by fuming chlorhydric acid, with combination; this absorption is rapid at 100°. Very soluble in alcohol and in most inflammable liquids. Much more soluble in the neutral solvents than most other gases, even than olefiant gas. (Berthelot & De Luca, *Ann. Ch. et Phys.*, (3.) **43.** pp. 276, 404.) Almost as soluble in monohydrated sulphuric acid as carbonic acid is in potash: — 35 grammes of this acid can absorb nearly 4 litres of the gas (200 vols. = $\frac{1}{4}$ of an equivalent). When this solution is diluted with water, no gas is evolved, but the solution becomes somewhat cloudy. (Berthelot, *Ibid.*, (3.) **43.** 399.) By ebullition it is disengaged from its solutions. (Berthelot, *Ibid.*, (3.) **51.** 69.)

Propylic Alcohol. *Vid.* Hydrate of Propyl.

Propylic Aldehyde. *Vid.* Hydride of Propionyl.

PropylGlycol. Soluble in all proportions in water, and alcohol.



$C_6 H_8 O_4 = \left.\begin{matrix} C_6 H_6'' \\ H_2 \end{matrix}\right\} O_4$

"**PropylOxySulphoCarbonate of** *X.*" *Vid.* OxySulphoCarbonate of *X* & of Propyl.

Propyl*bi*SulphoCarbonate of *X.*" *Vid.* OxySulphoCarbonate of *X* & of Propyl.

PropylSulphuric Acid. *Vid.* SulphoPropylic Acid.

Prussic Acid. *Vid.* Cyanhydric Acid.

PseudErythrin. *Vid.* Orsellate of Ethyl.

PseudoAcetic Acid. *Vid.* ButyroAcetic Acid; compare Propionic Acid, with which it is almost, if not quite identical.

PseudoMorphine. Soluble in 800 @ 900 pts. of cold, and in 12.5 pts. of hot water. Still less soluble in alcohol, and ether. No more soluble in ammonia-water than in cold water, but easily soluble in aqueous solutions of potash and soda. Almost insoluble in absolute alcohol, though somewhat soluble in spirit of 0.833 sp. gr. Almost insoluble in weak acids. (Pelletier.)
(*Phormia.*)
$C_{27} H_{18} N O_{14}$

PseudOrcin. *Vid.* ErythroMannite.

PseudoSulphoCyanogen. *Vid.* PerSulphoCyanogen.
$C_6 H N_3 S_6$

Pseudotoxin (from the leaves of *Atropa belladonna*). Soluble in water, and spirit. Insoluble in absolute alcohol or in ether. (Brandes.)

PseudoVeratrin (from *Veratrum sabadilla*). Insoluble in water, ether, or aqueous alkaline solutions. Soluble in alcohol.
(*Hellonin. Veratrin resin.*)
$C_{14} H_9 N O_3$

Pteleic Acid. All of its salts are soluble in water. (Kane.)
$C_6 H_4 O$

Pteritannic Acid. Insoluble in water. Easily soluble in strong alcohol, and ether; less soluble in weak alcohol. Insoluble in naphtha, or in fatty or essential oils. (Luck.)

$C_{24} H_{14} O_7, H O$

Pteritannate of Ethyl. Insoluble in water. Easily soluble in alcohol, with subsequent decomposition. Easily soluble in ether. Soluble in concentrated sulphuric acid, from which it is reprecipitated on the addition of water. Soluble in alkaline solutions. (Luck.)

(*Ethyl Pteritannic Acid.*)
$C_4 H_5 O, H O, 2 C_{24} H_{14} O_7$

Pteritannate of Ethyl & of Lead. Ppt.

Pteritannate of Lead.

I.) *mono.* Ppt.
$C_{24} H_{14} Pb O_8$

II.) *sesquibasic.* Ppt.
$2 C_{24} H_{14} Pb O_8 ; Pb O, H O$

III.) *acid.* Ppt.
$C_{24} H_{14} Pb O_8 ; C_{24} H_{15} O_8$

Punicin (from *Punica granatum*). Soluble in acids. (Righini.)

Purple of Cassius. See Stannate of Gold.

Purpuric Acid. Unknown.
$C_{16} H_5 N_5 O_{12}$

Purpurate of Ammonia. Soluble in 1500 pts. of water. (Prout); in 3000 pts. of water at 15°, and in a much smaller quantity of hot water. (Vauquelin.) 100 pts. of water at 15.5° dissolve 0.066 pts. of it. (Ure's *Dict.*) Insoluble in alcohol, or ether. (Prout; Kodweiss.) Soluble in an aqueous solution of caustic potash. Not perceptibly soluble in a saturated aqueous solution of carbonate of ammonia. (Liebig & Wœhler.) Easily soluble, without decomposition, in strong acetic acid. (Kodweiss.) Insoluble in glacial acetic acid. (Gm.) Decomposed by mineral acids.

(*Murexid.*)
$C_{16} H_4 (N H_4) N_5 O_{12} + 2 Aq$

Purpurate of Baryta. Very sparingly soluble in water. (Prout.)

Purpurate of Lead. Ppt.

Purpurate of Lime. Scarcely at all soluble in water, being less soluble in cold water than the baryta or strontia salt, but more soluble in hot water. (Prout.)

Purpurate of Magnesia. Very soluble in water. (Prout.)

Purpurate of Nicotin. Insoluble, or but sparingly soluble in water. Decomposed by alcohol. Soluble in cold, moderately dilute potash-lye. (Schwarzenbach.)

Purpurate of Potash. Sparingly soluble in an aqueous solution of caustic potash, and still less soluble in solutions of nitrate of potash and of other salts. (Fritzsche.)

Purpurate of Silver.

I.) *normal.* Sparingly soluble in water.
$C_{16} H_4 Ag N_5 O_{12} + 3 Aq$

II.) *di.* Sparingly soluble in water.
$C_{16} H_3 Ag_2 N_5 O_{12}$

III.) *tetra.* Ppt.
$C_{16} H_3 Ag_2 N_5 O_{12} ; 2 Ag O$

Purpurate of Soda. Soluble in 3000 pts. of water at 15°. (Prout.)

Purpurate of Strontia. Sparingly soluble in water. (Prout.)

PurpureoCobalt. The salts of purpureocobalt are generally less soluble than those of roseocobalt. Their neutral solutions are readily decomposed by heat.

$5 N H_3 . Co_2$

Purpurin. Scarcely at all soluble in water. (Gaultier & Persoz.) Sparingly soluble in cold water. (Runge; Debus.) Sparingly soluble in cold, more readily soluble in hot water. (Schiel; Debus.) From the hot aqueous solution it does not separate out again on cooling. (Runge.) More easily soluble than alizarin in warm water. (Strecker, *J. Ch. Soc.*, 3. 254.) After having been moistened with alcohol it dissolves more readily in water. (Schiel.) Soluble in absolute alcohol. (Runge.) Soluble in cold, and more abundantly in hot alcohol. (Wolff & Strecker.) Soluble both in strong alcohol and weak spirit. (Strecker, *J. Ch. Soc.*, 3. 254.) Very readily soluble in ether. (Gaultier & Persoz; Runge.) Soluble in ether. (Strecker, *loc. cit.*) Readily soluble in an aqueous solution of alum (Colin & Robiquet), when this is hot and concentrated (Strecker, *loc. cit.*), and in solutions of the salts of alumina, and of aluminate of potash (Gaultier & Persoz), of cold sulphide of ammonium (G. & P.), and of caustic ammonia (Runge), of the caustic alkalies (G. & P.; Runge; Schiel; Wolff & Strecker; Strecker, *loc. cit.*), and in all proportions in a solution of protoxide of tin in caustic potash. (G. & P.) Insoluble in cold aqueous solutions of the alkaline carbonates (Wolff & Strecker), but is dissolved by hot solutions, from which it separates again on cooling. (G. & P.) Insoluble in the cold, but soluble in a boiling concentrated solution of carbonate of soda. (Strecker, *loc. cit.*) Insoluble in a solution of chloride of tin. Soluble in concentrated sulphuric acid (Strecker, *loc. cit.*), from which it is precipitated on the addition of a quantity of water equal to $\frac{1}{4}$ @ $\frac{1}{3}$ of the sulphuric-acid solution. (Schiel.) Even when the latter is heated to 110° the purpurin is not changed, but is again separated when the hot solution is slowly poured into cold water. (Schiel.) It dissolves unchanged in hot fuming sulphuric acid, and is not decomposed until the temperature has reached 200°. (Debus.) When boiled with dilute acids, a yellow solution is formed, from which it separates on cooling. (Runge.)

(*Madder Purple. Oxylizaric Acid.*)
$C_{18} H_6 O_6 = C_{18} H_4 O_4, 2 H O \& + Aq$

The compounds of purpurin with metallic oxides, excepting those of potash, soda, and ammonia, are insoluble in water or alcohol. (Debus.) Its compounds with the alkalies are insoluble in the aqueous solutions of many salts, and in a cold strong solution of carbonate of soda. (Strecker, *J. Ch. Soc.*, 3. 255.)

Purpurin with Oxide of Lead. Insoluble in water, or alcohol. Soluble in an aqueous solution of caustic potash, and in acetic acid. (Debus.)

$5 C_{18} H_5 O_5, 6 Pb O$

Pyrene. *Vid.* ParaNaphthalin.

Pyridin. Soluble in all proportions in water. Readily soluble in the fixed and volatile oils. Readily soluble in acids, with combination, forming salts which are for the most part easily soluble in water. (Anderson.)

$N \left\{ C_{10} H_5''' \right.$

PyroAcetic Ether. }
PyroAcetic Spirit. } *Vid.* Acetone.

PyroAcetic Oil. *Vid.* Dumasin.

PyroAconitic Acid. *Vid.* Itaconic Acid.

PyroAlizaric Acid. *Vid.* Pthalic Acid (Anhydrous).

PyroBenzolin. *Vid.* Lophin.

PyroCatechin.
PyroCatechusic Acid. } *Vid.* OxyPhenic Acid.

PyroCitramid.
$C_{10} H_8 N_2 O_4$

PyroCitric Acid(of Robiquet). *Vid.* Citraconic Acid.

PyroCitric Acid(of Lassaigne). *Vid.* Itaconic Acid.

PyroCitric Chloride. *Vid.* ChloroPyroCitryl.
$C_{10} H_4 O_4, Cl_2$

PyroCitrimid. *Vid.* Citraconimid.

PyroComenic Acid. *Vid.* ParaComenic Acid.

PyroConiin. Soluble, with combination, in acetic acid. (J. D. Morries.)

PyroDextrin.
(*Pyro Glucic Acid.*)
$C_{48} H_{37} O_{37}$
Permanent. Very readily soluble in water. Alcohol of 22% dissolves traces of it; but it is insoluble in concentrated alcohol or ether. (Gélis, *Ann. Ch. et Phys.*, (3.) **52.** —.)

PyroDextrin with Baryta.
$C_{48} H_{36} O_{36}, 2 Ba O$
Sparingly soluble in water. Insoluble in alcohol, even when this is very dilute; it is completely precipitated from the aqueous solution when 10% of ordinary alcohol is added to the latter. (Gélis, *loc. cit.*)

PyroDextrin with Oxide of Lead.
$C_{48} H_{36} O_{36}, Pb O$
Very soluble in water. Insoluble in alcohol. (Gélis, *loc. cit.*)

PyroGallic Acid.
(*Isomeric with Frangulin and Phoro Glucin.*)
$C_{12} H_6 O_6 = C_{12} H_5 O_5, H O$
Permanent. Soluble in 2.25 pts. of water at 13°. (Braconnot.) Soluble in alcohol, and ether. (Braconnot; Pelouze.) Less soluble in alcohol than in water. (Stenhouse.) Soluble in cold concentrated sulphuric acid, apparently without decomposition. (Gmelin.) Decomposed by dilute sulphuric acid.

The salts of pyrogallic acid are more soluble in water than the corresponding gallates.

PyroGallate of Alumina. Soluble in water. (Braconnot.)

PyroGallate of Ammonia.

PyroGallate of Antimony.
$Sb O_3, C_{12} H_5 O_5$
Insoluble in water and the other neutral solvents. Easily soluble in dilute chlorhydric acid. (Rosing.)

PyroGallate of Bismuth. Ppt.

PyroGallate of Copper. Sparingly soluble in water. (Stenhouse.)

PyroGallate of Lead.

I.) $C_{12} H_5 Pb O_6 ; Pb O, H O$

II.) $C_{12} H_5 Pb O_6 ; Pb O, H O ; 5 Pb O$ Insoluble in water. (Berzelius.)

III.) $2 C_{12} H_5 Pb O_6 ; Pb O, H O + 4 Aq$

PyroGallate of Potash. Very soluble in water. (Pelouze.)

PyroGallate of Soda. Very readily soluble in water. (Pelouze.)

PyroGallate of Tin.

PyroGallate of Uranium. Ppt.

PyroGlucic Acid. *Vid.* PyroDextrin.

PyroGuaiacic Acid.
(*Guajacol. Hydride of Guaiacyl. Isomeric with Orcin and Saligenin.*)
$C_{14} H_8 O_4 = C_{14} H_7 O_3, H O$
Permanent. Sparingly soluble in water. Soluble in all proportions in alcohol, and ether. Readily soluble in acetic acid, even when this is tolerably dilute, and in other dilute acids. Easily soluble in dilute aqueous solutions of caustic potash, soda, and ammonia, and in concentrated sulphuric acid, from which it is partially precipitated on the addition of water. (Vœlckel, *Ann. Ch. u. Pharm.*, **89.** 354.) Soluble in a solution of caustic potash, but insoluble in ammonia-water, or in aqueous solutions of the carbonated alkalies. (Sobrero.) The compounds of pyroguaiacic acid with the alkaline earths are sparingly soluble in water, those of the oxides of the metals proper insoluble, or but sparingly soluble. (Unverdorben.)

PyroGuaiacate of Ammonia.

PyroGuaiacate of Lead.

I.) *basic.*
$C_{14} H_7 Pb O_4 ; Pb O, H O$
Insoluble in water. Soluble in strong alcohol. (Sobrero.)

PyroGuaiacate of Potash.
$C_{14} H_7 K O_4 + 4 Aq$
Soluble in water. Sparingly soluble in absolute alcohol, and still less soluble in ether. (Unverdorben.)

PyroGuaiacin.
$C_{38} H_{22} O_6$
Insoluble in water. Soluble in alcohol, and ether, and in a hot aqueous solution of caustic potash.

PyrOleic Acid. *Vid.* Sebacic Acid.

PyroLithofellic Acid.
(*Isomeric with Asclepion.*)
$C_{40} H_{34} O_6 = C_{40} H_{33} O_5, H O$

PyrOlivilic Acid.
$C_{40} H_{12} O_{10} = C_{40} H_{11} O_9, H O$
Sparingly soluble in water. Easily soluble in alcohol, and ether. Also in alkaline solutions.

PyrOlivilate of Lead.
$C_{40} H_{11} Pb O_{10}$
Insoluble in water. Soluble in alcohol.

PyroMalic Acid. *Vid.* Maleic Acid.

PyroMaric Acid. *Vid.* Sylvic Acid, under Resins(of Turpentine).

PyroMeconic Acid.
(*Isomeric with Pyro Mucic Acid.*)
$C_{10} H_4 O_6 = C_{10} H_3 O_5, H O$
Readily soluble in warm, less soluble in cold water, and spirit. More readily soluble in alcohol than in water. (Robiquet; Stenhouse.) Soluble in ether (John), and in naphtha (rock-oil). (Choulant.) Soluble in warm concentrated sulphuric acid, without decomposition, being deposited again on cooling. (Brown.)

PyroMeconate of Baryta.
$C_{10} H_3 Ba O_6 + Aq$
More soluble in water than the lime, magnesia, or strontia salt. Sparingly soluble in alcohol. (Brown.)

PyroMeconate of Copper.
$C_{10} H_3 Cu O_6$
Very sparingly soluble in boiling water, or alcohol. (Stenhouse.)

PyroMeconate *of sesquioxide* **of Iron.**
$C_{30} H_9 Fe_2''' O_{18}$
Very sparingly soluble in water, either hot or cold. (Stenhouse.)

PyroMeconate of Lead.
$C_{10} H_3 Pb O_6$
Sparingly soluble in hot water. Less soluble in alcohol, either warm or cold.

PyroMeconate of Lime.
$C_{10} H_3 Ca O_6 + Aq$
Soluble in 322.6 pts. of water at 15.5°. Sparingly soluble in boiling alcohol, being less soluble in alcohol than in water. (Brown.)

PyroMeconate of Magnesia. $C_{10} H_3 Mg O_6$ Insoluble in water, or alcohol. (Brown.)

PyroMeconate of Silver. $C_{10} H_3 Ag O_6$ Very sparingly soluble in water, decomposing even in the cold. (Stenhouse.)

PyroMeconate of Strontia. $C_{10} H_3 Sr O_6 + Aq$ Slightly soluble in cold, more readily soluble in warm water, and alcohol. (Brown.)

PyroMellic Acid. (*PyroMellithic Acid.*) $C_{20} H_6 O_{16} = C_{20} H_2 O_{12}, 4 H O$ Sparingly soluble in cold, abundantly soluble in boiling water. The acid which has been dried at 120° is soluble in 70.42 pts. of water at 16°. Readily soluble in alcohol. Soluble, without much decomposition, in boiling concentrated sulphuric, nitric, and chlorhydric acids, and in aqua-regia. (Erdmann.) Its salts are all soluble in free pyromellic acid.

PyroMellate of Ammonia. Readily soluble in water. Insoluble in strong alcohol, sparingly soluble in weak alcohol.

PyroMellate of Baryta. Insoluble in boiling water.

PyroMellate of Gold.

PyroMellate *of sesquioxide* **of Iron.** Ppt.

PyroMellate of Lead. $C_{20} H_2 Pb_4 O_{16} + 2 Aq$ Insoluble in boiling water.

PyroMellate of Lime. Insoluble in boiling water.

PyroMellate of Manganese.

PyroMellate *of dinoxide* **of Mercury.** Ppt.

PyroMellate *of protoxide* **of Mercury.** Ppt.

PyroMellate of Nickel.

PyroMellate of Potash. Readily soluble in water. Insoluble in strong, sparingly soluble in weak alcohol.

PyroMellate of Silver. $C_{20} H_2 Ag_4 O_{16}$ Almost insoluble in boiling water.

PyroMellate of Soda. Readily soluble in water. Insoluble in strong, sparingly soluble in weak alcohol.

PyroMellate of Zinc.

PyroMellitic Acid. *Vid.* PyroMellic Acid.

PyroMoric Acid. } *Vid.* OxyPhenic Acid.
PyroMoriTannic Acid. }

PyroMucamid. (*PyroMucylamid.*) $C_{10} H_5 N O_4 = N \left\{ \begin{matrix} C_{10} H_3 O_4 \\ H_2 \end{matrix} \right.$ Soluble in water, alcohol, and ether. (Malaguti.)

***Bi*PyroMucamid.** (*PyroMucamide biamidée.*) $C_{10} H_6 N_2 O_2 = N_2 \left\{ \begin{matrix} C_{10} H O_2 \\ H_5 \end{matrix} \right.$ Sparingly soluble in cold water. More soluble than pyromucic acid in water. More soluble in alcohol, and ether, than in water. (Malaguti.)

PyroMucic Acid. (*Furfuric Acid. Isomeric with PyroMeconic Acid.*) $C_{10} H_4 O_6 = C_{10} H_3 O_5, H O$ Soluble in 28 pts. of water at 15°. (Houton-Labillardière); and in 4 pts. of boiling water. (Trommsdorff.) More soluble in alcohol than in water.

PyroMucate of Ammonia.

PyroMucate of Baryta. $C_{10} H_3 Ba O_6$ Permanent. Difficultly soluble in water, though somewhat more readily in hot than in cold. Insoluble in alcohol. (Houton-Lab.)

PyroMucate of ***quadri*ChlorEthyl.** (*Ether ChloroPyroMucique.*) $C_{10} H_3 (C_4 H Cl_4) O_6$ Decomposed by water. Easily soluble in alcohol, and ether. (Malaguti.)

PyroMucate of Copper. Sparingly soluble in water. (Houton-Labillardière.)

PyroMucate of Ethyl. $C_{10} H_3 (C_4 H_5) O_6$ Very sparingly soluble in water. Soluble in all proportions in alcohol, and ether. Easily soluble, without decomposition, in cold concentrated sulphuric and chlorhydric acids. (Malaguti.)

PyroMucate *of protoxide* **of Iron.** Very soluble in water. (Houton-Labillardière.)

PyroMucate *of sesquioxide* **of Iron.** Ppt.

PyroMucate of Lead. Soluble in water.

PyroMucate of Lime. Permanent. Somewhat more readily soluble in hot than in cold water. Insoluble in alcohol. (Houton-Labillardière.)

PyroMucate of Magnesia.

PyroMucate *of dinoxide* **of Mercury.** Insoluble in water.

PyroMucate of Nickel. Ppt.

PyroMucate of Potash. $C_{10} H_3 K O_6$ Deliquescent. Very soluble in water, and alcohol. Also soluble in ether.

PyroMucate of Silver. $C_{10} H_3 Ag O_6$ Soluble in water.

PyroMucate of Soda. Less deliquescent and less soluble in water than the potash salt. (Houton-Labillardière.)

PyroMucate of Strontia. Permanent. Somewhat more readily soluble in hot than in cold water. Insoluble in alcohol. (Houton-Lab.)

PyroMucate *of protoxide* **of Tin.** Ppt.

PyroMucate of Zinc. Soluble in water.

PyroPectic Acid. Insoluble in water. Soluble in alkaline liquors. (Fremy, *Ann. Ch. et Phys.*, (2.) **24.** 39.)

PyroPimaric Acid. *Vid.* Sylvic Acid, under Resins(of Turpentine).

PyroQuinic Acid(of Pelletier & Caventou). Appears to be a mixture.

PyroRacemic Acid(oily). *Vid.* Pyruvic Acid.

"**PyroRacemic Acid**"(crystalline). *Vid.* PyroTartaric Acid.

Pyroretin. *Vid.* Scleretinite, under Resins (fossil).

PyroSorbic Acid. *Vid.* Maleic Acid.

PyroTartanil. *Vid.* PhenylPyroTartrimid.

PyroTartanilic Acid. *Vid.* PhenylPyroTartramic Acid.

***Bi*PyroTartramid.** *Vid.* PyroTartrimid.

PyroTartranil. *Vid.* PhenylPyroTartrimid.

PyroTartranilic Acid. *Vid.* PhenylPyroTartramic Acid.

PyroTartoNitranil. *Vid.* NitroPhenylPyroTartrimid.

PyroTartoNitrAnilic Acid. *Vid.* NitroPhenylPyroTartramic Acid.

PyroTartaric Acid(Anhydrous). (*PyroTartric Anhydride.*) $C_{10} H_6 O_6 = C_{10} H_6 O_4'' \{ O_2$ Very sparingly soluble in water, by which it is slowly converted into the hydrated acid. Easily soluble in alcohol, from which it is precipitated on the addition of water. By alkaline solutions it is quickly converted into the hydrated acid. (Arppe.)

PyroTartaric Acid. (*Crystalline Pyro Racemic Acid.*) Permanent. Much more soluble in water than its isomer, lipic acid. (Wirz.) Soluble in 4 pts. of water at 12.5° (Gœbel); in 3 pts. of water at 15° (Gruner); and in 1.5 pts. of water at 20°. (Arppe.) Very soluble in alcohol, and ether. (Arppe.) Soluble, without decomposition, in concentrated sulphuric, chlorhydric, nitric, and acetic acids. Most of the salts of pyrotartaric acid are soluble in water, but are only very sparingly soluble in alcohol. (Arppe.)

$C_{10}H_8O_8 = C_{10}H_6O_6, 2\,HO$

PyroTartrate of Alumina.

I.) *monobasic.* Insoluble in water. Soluble in an aqueous solution of normal pyrotartrate of soda. (Arppe.)

$Al_2O_3, C_{10}H_6O_8 + 2\,Aq$

II.) *acid.* Soluble in water.

PyroTartrate of Ammonia.

I.) *normal.* Very easily soluble in water. Sparingly soluble in cold, and is decomposed by boiling alcohol. (Arppe, *Ann. Ch. u. Pharm.*, **87.** 229.)

$C_{10}H_6(NH_4)_2O_8$

II.) *acid.* Permanent. Readily soluble in water. (Gruner.) Difficultly soluble in boiling, and still less soluble in cold alcohol. (Arppe.)

$C_{10}H_7(NH_4)O_8$

PyroTartrate of Anilin(?). Soluble in water.

PyroTartrate of Baryta.

I.) *normal.* Readily soluble in hot and in cold water; from which solution it is precipitated on the addition of alcohol. (Arppe.)

$C_{10}H_6Ba_2O_8 + 4\,Aq$

II.) *acid.* Permanent. Very soluble in water. Alcohol removes half the acid. (Arppe.)

$C_{10}H_7BaO_8 + 2\,Aq$

PyroTartrate of Bismuth.

I.) [Soluble in a small amount of water ?] The solution becomes cloudy on ebullition, but clears up again on cooling. On the addition of much water the following compound (No. II.) is precipitated.

II.) $C_{30}H_{18}(Bi'')_3O_{24} + 4\,Aq$ Ppt.

PyroTartrate of Cadmium.

I.) *normal.* Very soluble in water. Alcohol removes a portion of the acid.

$C_{10}H_6Cd_2O_8 + 4\,Aq$ & $6\,Aq$

II.) *acid.* Soluble in water. Insoluble in alcohol.

PyroTartrate *of violet sesquioxide* **of Chromium.** Soluble in water.

PyroTartrate of Cobalt.

I.) Difficultly soluble in water.

II.) *basic.* Insoluble in water.

$C_{10}H_6Co_2O_8, 8\,CoO + 12\,Aq$

PyroTartrate *of protoxide* **of Copper.**

I.) *normal.* Soluble in about 250 pts. of water. (Pelouze.) Scarcely at all soluble in alcohol. Easily soluble in ammonia-water, and in acids. (Arppe.)

$C_{10}H_6Cu_2O_8 + 4\,Aq$

II.) *basic.* Ppt.

$C_{10}H_6Cu_2O_8;\ 2\,CuO + 4\,Aq$

PyroTartrate of Ethyl.

I.) *normal.* Nearly insoluble in water, in contact with which it is slowly decomposed. Soluble in all proportions in alcohol, and ether. Readily soluble in cold concentrated sulphuric and chlorhydric acids. (Gruner.)

$C_{10}H_6(C_4H_5)_2O_8$

PyroTartrate of Glucina.

I.) *normal.*

$C_{30}H_{18}(Gl_2''')_2O_{24}$

II.) *acid.* Soluble in water.

$Gl_2O_3, 6\,C_{10}H_8O_8 + 7\,Aq$

PyroTartrate *of protoxide* **of Iron.** Soluble in water.

PyroTartrate *of peroxide* **of Iron.**

I.) *normal.* Insoluble in water, or alcohol. (Arppe.)

$C_{30}H_{18}(Fe_2''')_2O_{24}$

II.) *monobasic.* Soluble in 200 pts. of cold water. Insoluble in alcohol. (Pelouze.)

$Fe_2O_3, C_{10}H_8O_8 + 3\,Aq$

III.) *hexa.* Insoluble in water. Very sparingly soluble in acetic acid; abundantly soluble in nitric acid. (Arppe.)

$6\,Fe_2O_3, C_{10}H_8O_8 + 4\,Aq$

IV.) 18 *basic.* Insoluble in water.

$18\,Fe_2O_3, C_{10}H_8O_8 + 16\,Aq$

V.) *peracid.* Easily soluble in water. Decomposed by alcohol.

$Fe_2O_3, 9\,C_{10}H_8O_8$

PyroTartrate of Lead.

I.) *normal.* Very sparingly soluble in cold, more readily soluble in hot water. (Weniselos.) Insoluble in alcohol. Soluble in an aqueous solution of acetate of lead. (Arppe.)

$C_{10}H_6Pb_2O_8 + 4\,Aq$

II.) *tetra.* Completely insoluble in water.

$C_{10}H_6Pb_2O_8;\ 2\,PbO$

III.) *hexa.* Insoluble in water. Soluble in an aqueous solution of subacetate of lead, and in acids. (Pelouze.)

$C_{10}H_6Pb_2O_8;\ 4\,PbO$

PyroTartrate of Lime.

I.) *normal.* Sparingly soluble in water, requiring nearly 100 pts. thereof for its solution. Very soluble in acetic, chlorhydric, and nitric acids. Insoluble in alcohol. (Arppe.)

$C_{10}H_6Ca_2O_8 + 4\,Aq$

II.) *peracid.* Easily soluble in water. (Gruner.)

$C_{10}H_7CaO_8, 2\,C_{10}H_8O_8 + 2\,Aq$

PyroTartrate of Magnesia.

I.) *normal.* Very readily soluble in water, from which it is precipitated on the addition of alcohol. (Arppe.)

$C_{10}H_6Mg_2O_8 + 6\,Aq$ & $12\,Aq$

II.) *acid.* Soluble in water.

PyroTartrate of Manganese.

I.) *normal.* Readily soluble in water, from which it is precipitated by alcohol. (Arppe.)

$C_{10}H_6Mn_2O_8 + 6\,Aq$

PyroTartrate *of dinoxide* **of Mercury.** Nearly insoluble in water. Somewhat soluble in an aqueous solution of normal pyrotartrate of soda. Easily soluble in nitric acid. (Arppe.) Insoluble in alcohol, or ether. (Harff.)

PyroTartrate *of protoxide* **of Mercury.** Soluble in 119 pts. of water, the solution undergoing decomposition when boiled; more readily soluble in acidulated water, and in concentrated sulphuric acid, especially if this is warm. Nearly insoluble in alcohol, or ether. (Harff.)

PyroTartrate of Methyl. Sparingly soluble, or insoluble, in water. (Arppe.)

PyroTartrate of Nickel.

I.) *normal.* Very sparingly soluble in water. Insoluble in alcohol. (Arppe.)
$C_{10}H_6Ni_2O_8 + 4\,Aq$

II.) *peracid.* Soluble in water. Decomposed by alcohol.
$C_{10}H_7NiO_8, C_{10}H_8O_8 + 2\,Aq$

PyroTartrate of Potash.

I.) *normal.* Deliquesces in moist air. Soluble in water, from which it is precipitated on the addition of alcohol. The anhydrous salt is insoluble in absolute alcohol; the hydrated salt is somewhat soluble in hot, less soluble in cold, absolute alcohol. (Arppe.)
$C_{10}H_6K_2O_8 + 2\,Aq$

II.) *acid.* Permanent. Somewhat less soluble than the normal salt in water. Difficultly soluble in boiling alcohol. (Arppe.)
$C_{10}H_7KO_8$

PyroTartrate of Silver.

I.) *normal.* Sparingly soluble in cold water. Readily soluble in nitric and acetic acids, and in ammonia-water. (Arppe.)
$C_{10}H_6Ag_2O_8$

PyroTartrate of Soda.

I.) *normal.* Efflorescent. Very soluble in water. Insoluble in alcohol, even boiling. (Arppe.)
$C_{10}H_6Na_2O_8 + 6\,Aq \;\&\; 12\,Aq$

II.) *acid.* Readily soluble in water. Insoluble in alcohol. (Weniselos.)
$C_{10}H_7NaO_8$

PyroTartrate of Strontia.

I.) *normal.* Easily soluble in water, from which it is precipitated by alcohol. (Arppe.) Sparingly soluble in water; insoluble in alcohol. (Gruner.)
$C_{10}H_6Sr_2O_8 + 2\,Aq$

II.) *acid.* Soluble in water. Decomposed by alcohol. (Arppe.)
$C_{10}H_7SrO_8 + 2\,Aq$

PyroTartrate *of protoxide* of Tin.

I.) *tetra.* Soluble in a small quantity of water, from which solution it is precipitated on the addition of much water, or alcohol.
$C_{10}H_6Sn_2O_8, 2\,SnO$

II.) *basic.* Insoluble in water.

PyroTartrate *of sesquioxide* of Uranium. Readily soluble in water, from which solution it is precipitated on the addition of alcohol. (Arppe.)
$3\,Ur_2O_3, 3\,C_{10}H_8O_8 + Aq$

PyroTartrate of Zinc.

I.) *normal.* Soluble in water, from which it is precipitated on the addition of alcohol. (Arppe.)
$C_{10}H_6Zn_2O_8 + 6\,Aq$

II.) *acid.* Insoluble in water.

PyroTartrimid. Readily soluble in water, alcohol, ether, alkaline solutions, and the ordinary acids. (Arppe, *Ann. Ch. u. Pharm.*, **87.** 233.)
(*BiPyroTartramid. PyroTartrylamid.*)
$C_{10}H_7NO_4 = N\left\{\begin{matrix}C_{10}H_6O_4''\\H\end{matrix}\right.$

PyroTartrimid with Oxide of Lead. Partially soluble in water. (Arppe, *loc. cit.*)
$C_{10}H_7NO_4, 5\,PbO + 5\,Aq$

PyroTartoNitranil. *Vid.* NitroPhenylPyroTartrimid.

PyroTartonitranilic Acid. *Vid.* NitroPhenylPyroTartramic Acid.

PyroTartranile. *Vid.* PhenylPyroTartrimid.

PyroTartroNitranil. *Vid.* NitroPhenylPyroTartrimid.

PyroTartroNitrAnilic Acid. *Vid.* NitroPhenylPyroTartramic Acid.

PyroTartrylNitroPhenylamid. *Vid.* NitroPhenylPyroTartrimid.

PyroTerebic Acid. Permanent. Soluble in 25 pts. of water; more soluble in alcohol, and ether. (Rabourdin.) The alkaline pyroterebates are soluble in water.
(*Pyro Terebilic Acid.*)
$C_{12}H_{10}O_4 = C_{12}H_9O_3, HO$

PyroTerebate of Lead.

I.) *basic.* Insoluble in water.

II.) *acid.* Soluble in water.

PyroTerebate of Silver. Sparingly soluble in water. (Rabourdin.)

PyroTerebilic Acid. *Vid.* PyroTerebic Acid.

PyroUric Acid. *Vid.* Cyanuric Acid.

Pyroxam. *Vid.* Xyloidin.

PyroXanthin. Soluble in warm spirit, ether, and acetic acid, crystallizing from the two first on cooling. Water precipitates it from its solution in alcohol and acetic acid. Soluble in cold concentrated sulphuric acid, with subsequent decomposition. Also soluble in sulphuric acid diluted with an equal volume of water, when this is gently heated, but after a few days the solution suffers decomposition. Soluble in highly concentrated chlorhydric acid, the solution undergoing decomposition when exposed to the air. When water is added to the sulphuric or chlorhydric solutions immediately after their formation, the pyroxanthin is reprecipitated unchanged. Soluble in strong nitric acid, with decomposition. Only very sparingly soluble in aqueous solutions of caustic potash or ammonia, even at 100°. (Apjohn & Gregory, *Ann. Ch. u. Pharm.*, 1837, **21.** 145.)
(*Eblanin.*)
$C_{20}H_8O_4 = \left.\begin{matrix}C_{20}H_7O_2\\H\end{matrix}\right\}O_2$

PyroXanthogene. Very sparingly soluble in cold, more readily soluble in hot water. Readily soluble in alcohol, wood-spirit, and ether. (Schweizer.)

Pyroxilic Spirit. *Vid.* Hydrate of Methyl.

Pyroxilin. *Vid.* Gun-Cotton.

Pyrrol. Nearly insoluble in water. Easily soluble in alcohol, and ether. Insoluble in aqueous solutions of the caustic alkalies. Slowly soluble in sulphuric and chlorhydric acids. Dissolves rapidly, with decomposition, in nitric acid. (Anderson.)
$C_8H_5N = N\left\{C_8H_5'''\right.$

Pyrrol Red. Insoluble in water, dilute acids, or alkaline solutions.
$C_{24}H_{14}N_2O_2$

Very sparingly soluble in cold alcohol or ether. Somewhat more soluble in hot alcohol. (Anderson; Schwanert.)

Sparingly soluble in water, ether, acids, and ammonia-water. Easily soluble in alcohol. (O. Hesse')

Pyruvic Acid. Miscible in all proportions with water, alcohol, and ether. (Berzelius.) Soluble, apparently without decomposition, in cold concentrated nitric acid, but the solution is decomposed when heated. (Vœlckel, *Ann. Ch. u. Pharm.*, **89.** 69.) The pyruvates of metallic oxides occur in two modifications, — the one crystalline, the other gummy. Most of them are soluble in water, and most of
(*OilyPyroRacemic Acid. Brenztraubensœure.*)
$C_6H_4O_6 = C_6H_3O_5, HO$

those not soluble in water are soluble in aqueous solutions of the alkalies; many of them also in solutions of the alkaline carbonates. They are but sparingly soluble in alcohol, dissolving the less readily in proportion as the alcohol is more concentrated, and are insoluble in ether. Some of them are decomposed by water, others by alcohol. (Berzelius.)

Pyruvate of Alumina.

I.) *normal.* Soluble in water, and in aqueous solutions of the caustic and carbonated alkalies.

II.) *basic.*

Pyruvate of Ammonia. Deliquescent. Almost insoluble in alcohol. Insoluble in ether.

Pyruvate of Baryta.

α = *crystalline.* Permanent. Tolerably soluble in water. Insoluble in aqueous solutions of the alkaline carbonates.
$C_6 H_3 Ba O_6 + Aq$

β = *gummy.* Very slowly soluble in water, even when this is boiling.

Pyruvate of Bismuth.

β = *gummy.* Soluble in water, and in aqueous solutions of the caustic and carbonated alkalies.

Pyruvate of Cobalt.

α = *crystalline.* Very slowly soluble in water, even when this is acidulated with pyruvic acid.

β = *gummy.* Very soluble in water. Insoluble in aqueous solutions of the caustic or carbonated alkalies.

Pyruvate of Copper.

α = *crystalline.* Very sparingly soluble in cold, somewhat more soluble in hot water.
$C_6 H_3 Cu O_6 + Aq$

β = *gummy.* Tolerably soluble in water. Soluble in aqueous solutions of the caustic and carbonated alkalies.

Pyruvate of Glucina.

I.) *normal.* Soluble in water, and in aqueous solutions of the caustic and carbonated alkalies.

II.) *basic.* Insoluble in water.

Pyruvate *of protoxide* **of Iron.**

α = *crystalline.* Permanent in dry air. Sparingly soluble in water.

β = *gummy.* Readily soluble in water, and alcohol.

Pyruvate *of sesquioxide* **of Iron.**

I.) *normal.*

β = *gummy.* Soluble in water, and alcohol. Somewhat soluble in aqueous solutions of the caustic and carbonated alkalies.

II.) *basic.* Soluble in ammonia-water.

Pyruvate of Lead.

I.) *normal.*

α = *crystalline.* Sparingly soluble in water. (Berzelius.) Insoluble, or very sparingly soluble in water. (Vœlckel, *Ann. Ch. u. Pharm.*, 89. 70.)
$C_6 H_3 Pb O_6$

II.) *tri.* Very sparingly soluble in water.
$C_6 H_3 Pb O_6, 2 Pb O + Aq$

III.) *acid.* Decomposed by water.

Pyruvate of Lime.

a = *crystalline.* Soluble in cold water. Insoluble in aqueous solutions of the alkaline carbonates.

β = *gummy.*

Pyruvate of Lithia.

α = *crystalline.* Sparingly soluble in water.

β = *gummy.* More readily soluble in water than the crystalline modification.

Pyruvate of Magnesia. Insoluble in aqueous solutions of the alkaline carbonates.

Pyruvate of Manganese.

α = *crystalline.* Slowly soluble in cold, more soluble in hot water.

β = *gummy.* Readily soluble in water.

Pyruvate *of dinoxide* **of Mercury.** Sparingly soluble in boiling water, with partial decomposition.

Pyruvate *of protoxide* **of Mercury.**

I.) *normal.* Decomposed by water to a soluble acid and an insoluble basic salt.

II.) *basic.* Insoluble in boiling water.

Pyruvate of Nickel.

α = *crystalline.* }
β = *gummy.* } More difficultly soluble in water than the corresponding cobalt salts.

Pyruvate of Potash. Deliquescent. Soluble in water. Insoluble in ether.

Pyruvate of Silver.

a = *crystalline.* Soluble in boiling, but very sparingly soluble in cold water. Soluble in ammonia-water.
$C_6 H_3 Ag O_6$

β = *gummy.* Somewhat more soluble in hot than in cold water. (Berzelius.)

Pyruvate of Soda.

I.) *normal.*

a = *crystalline.* Soluble in water. Very sparingly soluble in boiling absolute alcohol; more, though still sparingly, soluble in spirit. Insoluble in ether.
$C_6 H_3 Na O_6$

β = *gummy.*

II.) *acid.* Soluble in water. Insoluble in alcohol.

Pyruvate of Strontia.

a = *crystalline.* Less soluble than the baryta-salt in water. Insoluble in aqueous solutions of the alkaline carbonates.
$C_6 H_3 Sr O_6 + 2 Aq$

β = *gummy.* Soluble in water.

Pyruvate of Thoria. Soluble in water, and ammonia-water.

Pyruvate of Uranium. Readily soluble in water.

Pyruvate of Yttria.

α = *crystalline.* Slowly soluble in water.

β = *gummy.* Somewhat soluble in water. Soluble in aqueous solutions of the caustic and carbonated alkalies.

Pyruvate of Zinc.

α = *crystalline.* Sparingly soluble in water.
$C_6 H_3 Zn O_6 + 3 Aq$

β = *gummy.* Easily soluble in water.

Pyruvate of Zirconia. Soluble in water, and ammonia-water.

Q.

QuadriChloride (&c.) **of** *X.* See under **Chloride** (&c.) of *X*, as *quadri*Chloride of *X*, *quadr*Oxalate of *X*, and the like.

Quassin. Permanent. Very sparingly soluble in water. 100 pts. of water at 12° dissolve only 0.45 pt. of it, i. e. 1 pt. of it is soluble in 222 pts. of water
(*Quassite, from Quassia amara.*)
$C_{20} H_{12} O_6$(?)

at 12°, and even this quantity is only slowly dissolved. Its solubility in water is increased to a remarkable extent by the presence of salts and of easily soluble organic substances, especially by those which accompany it in the quassia-wood. Very sparingly soluble in ether. Its best solvent is alcohol, which dissolves so much the more of it in proportion as it contains less water, and more readily when hot than in the cold. More soluble in dilute acids and alkaline solutions than in water. Abundantly soluble in cold concentrated sulphuric acid, from which it separates apparently unchanged on the addition of water. Decomposed by hot sulphuric acid. Abundantly soluble, apparently without decomposition, in cold nitric acid of 1.25 sp. gr., but is decomposed when this solution is heated. (Wiggers, *Ann. der Pharm.*, 1837, **21**. pp. 44 – 46.)

QUERCETIN. Permanent. Almost insoluble in cold, very sparingly soluble in boiling water. Readily soluble in alcohol. Soluble in warm acetic acid. Easily soluble in ammonia-water, and in dilute aqueous solutions of caustic potash and soda. (Rigaud, *Ann. Ch. u. Pharm.*, **90**. 294.)

$C_{24}H_9O_{11} = \left.\begin{matrix}C_{24}H_7O_8\\ H\end{matrix}\right\}O_2 + Aq$

QUERCIN (from the bark of *Quercus robur*). Easily soluble in water, and in dilute spirit. Insoluble in absolute alcohol, or ether. Soluble in lime-water. (Gerber.)

QUERCITE. Soluble in 8 @ 10 pts. of cold water. Tolerably easily soluble in warm dilute alcohol. Soluble in concentrated sulphuric acid, with combination.

(*Sugar of Acorns. Isomeric with Pinite, Dulcinam, and Mannitan.*)

$C_{12}H_{12}O_{10} = \left.\begin{matrix}C_{12}H_{10}O_6''\\ H_2\end{matrix}\right\}O_4$

QUERCITE with BARYTA. Soluble in water, and spirit.

$C_{12}H_{11}BaO_{10} + 3\,Aq$

QUERCITE with LEAD. Ppt.

QUERCITE with LIME.

QUERCITANNIC ACID.

QUERCITRIN. Almost insoluble in cold water. Soluble in 425 pts. of boiling water. (Rigaud, *Ann. Ch. u. Pharm.*, **90**. 287.) Soluble in 400 pts. of hot water, and in 4 @ 5 pts. of absolute alcohol. (Bolley.) Much more soluble in absolute or dilute alcohol than in water. Somewhat soluble in ether. Very sparingly soluble in ether. (Rigaud.) Soluble in warm acetic acid and in cold concentrated sulphuric acid. Sparingly soluble in cold concentrated chlorhydric acid. Easily soluble in warm concentrated chlorhydric acid, with decomposition. When boiled with acids, it is decomposed. Very easily soluble in weak aqueous solutions of caustic ammonia, and soda. (Rigaud, *loc. cit.*)

(*Rutin. Rutinic Acid. Rutic Acid. Quercitric Acid. Glucoside of Quercitin.*)

$C_{36}H_{19}O_{21} = \left.\begin{matrix}C_{24}H_7O_8\\ C_{12}H_{11}O_{10}\end{matrix}\right\}O_2 + Aq$

QUINIC ACID. *Vid.* Kinic Acid.

QUINICIN. Almost insoluble in water. Very soluble in absolute alcohol, and in ordinary spirit. (Pasteur.)

(*Chinicin. Isomeric with Quinine and Quinidin.*)

$N_2\left\{C_{40}H_{24}O_4^{vi}\right.$

"QUINIDIN (or Chinidin)" of Winckler, Leers, &c. *Vid.* Cinchonidin (of Pasteur & Gerhardt).

QUINIDIN. Efflorescent. Soluble in 1500 pts. of cold, and in 750 pts. of boiling water; in 45 pts. of cold absolute alcohol; in 3.7 pts. of warm ordinary alcohol, and in 90 pts. of cold ether. (Van Heijningen.) 100 pts. of chloroform dissolve 25.3 pts. of it. (Schlimpert, *Kopp & Will's J. B., für* 1859, p. 405.)

(*Chinidin. Quinoidin. Chinoidin. β Quinine. Isomeric with Quinine and Quinicin.*)

$N_2\left\{C_{40}H_{24}O_4^{vi} + 4\,Aq\right.$

Most of the salts of quinidin are more easily soluble in water than the corresponding salts of quinine. They are also easily soluble in alcohol, but are insoluble in ether.

QUININE. Soluble in about 350 pts. of cold, and in 200 pts. of boiling water, the boiling saturated solution containing 0.5% of it.

(*α Chinin. Isomeric with Quinidin and Quinicin.*)

$N_2\left\{C_{40}H_{24}O_4^{vi}\quad 6\,Aq\right.$

Soluble in 480 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8**. 201, in *Canstatt's Jahresbericht, für* 1854, p. 75.) Soluble in all proportions in cold absolute alcohol, and in ether; and in almost all proportions in cold alcohol of 90%. (Bussy & Guibourt, *Journ. de Pharm. et Chim.*, 1852, (3.) **22**. pp. 414, 413.) Extremely soluble in alcohol. Much more soluble than cinchonin in ether.

Soluble in 2 pts. of alcohol; 60 pts. of ether; 2 pts. of chloroform; and 24 pts. of olive-oil. (Parrish's *Pharm.*, p. 401.) 100 pts. of chloroform dissolve 15 pts. of pure quinine at the ordinary temperature. (Schlimpert, *Kopp & Will's J. B., für* 1859, p. 405.) 100 pts. of chloroform dissolve 57.47 pts. of it. (Michael Pettenkofer, *Kopp & Will's J. B., für* 1858, p. 363.) 100 pts. of olive-oil dissolve 4.2 pts. of it. (Michael Pettenkofer, *Kopp & Will's J. B., für* 1858, p. 363.) Also soluble in the other fatty and in essential oils. Tolerably soluble in benzin; more readily soluble in the vapor of benzin, as it condenses, than in boiling liquid benzin. (Mansfield, *J. Ch. Soc.*, **1**. 262.) Soluble in carbonic-acid water, with combination. (Langlois, *Ann. Ch. et Phys.*, (3.) **41**. 89.)

More soluble in lime-water than in pure water, though still but sparingly soluble; also soluble in aqueous solutions of chloride of calcium, chloride of ammonium, chloride of potassium, carbonate of ammonia, caustic potash, and ammonia. Insoluble in solutions of caustic soda, or of carbonate or sulphate of soda, or of chloride of sodium. Easily soluble in dilute acids. Soluble in cold concentrated sulphuric and nitric acids. The normal salts of quinine are mostly easily soluble in water, while the basic salts are difficultly soluble therein; but they are all easily soluble in alcohol, and dilute acids, and some of them are soluble in ether also. They are ordinarily less soluble in water than the corresponding salts of cinchonin.

βQUININE. } *Vid.* Quinidin.
QUINOIDIN. }

QUINOIL. *Vid.* Kinone.

QUINOLEIN. Sparingly soluble in cold, somewhat more soluble in boiling water. Less soluble than anilin in water. Ether removes it from the aqueous solution. Miscible in all proportions with alcohol, wood-spirit, ether, aldehyde, acetone, sulphide of carbon, and the fatty and essential oils. Easily soluble in all the acids. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9**. 169.) Quinolein dissolves a considerable quantity of water.

(*Chinolin. Leukol or Leucol. Leucolin. Chinolein. Chinoilin.*)

$N\left\{C_{18}H_{17}'''\right.$

Very sparingly soluble in water. When boiled with water it distils over without change. Soluble in acids, even in acetic, and the other vegetable acids. Very soluble in alcohol, ether, and the essential oils. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **7.** 252.)

According to Greville Williams the above statements refer to impure quinolein, that which was examined by Hofmann having been contaminated with lepidin($N\ C_{20}\ H_9$).

Quinone. *Vid.* Kinone.

Quinonamid. *Vid.* Kinonamid.

Quinonic Acid. *Vid.* Melanic Acid.

QuinoTannic Acid. *Vid.* KinoTannic Acid.

Quinovatic and Quinovic Acids. *Vid.* Kinovic Acid.

Quinqui. See *quinqui*, as prefix, under the generic name of the substance sought for.

R.

Racemic Acid. *Vid.* ParaTartaric Acid.

*Dextro*Racemic Acid. Identical with Tartaric Acid, *q. v.*

*Levo*Racemic Acid. *Vid. left*Tartaric Acid.

RacemoMethylic Acid. *Vid* MethylParaTartaric Acid.

RacemoVinic Acid. *Vid.* EthylParaTartaric Acid.

Raewsky's First Base.
$N_4\ H_{12}\ Pt_2\ Cl\ O_5$

Raewsky's Second Base.
$N_4\ H_{12}\ Pt_2\ Cl_2\ O_4$

Red Prussiate of Potash. *Vid.* Ferricyanide of Potassium.

Reiset's First Platinum Base. *Vid.* Platin(*ous*)*bi*amin.
$N_2\ H_6\ Pt\ O = N_2 \left\{ \begin{matrix} H_5 \\ Pt \end{matrix} \right. \cdot H\ O$

Reiset's Second Base. *Vid.* Platin(*ous*)amin.
$N\ H_3\ Pt\ O = N \left\{ \begin{matrix} H_2 \\ Pt \end{matrix} \right. \cdot H\ O$

Resins. The resins are insoluble in water. Many of them are soluble in alcohol, and in spirit, while others are insoluble therein. Most of them are soluble in ether. Many are soluble in wood-spirit, — at least many of the resins are soluble in some samples of common wood-spirit ("wood-naphtha"), — while other samples of this liquid dissolve them only imperfectly. This, of course, depends upon the fact that commercial wood-spirit is always a mixed and very variable product. (Graham, *et al.*, *J. Ch. Soc.*, **8.** 133.) In general, they are soluble in oil of turpentine, especially if this be hot. In oil of ocotea (Hancock), in oil of mandarin (Luca).

Many of them are readily and abundantly soluble in benzin (Mansfield, *J. Ch. Soc.*, **1.** 261), and several of them are much more readily dissolved by allowing the vapor of benzin, of oil of turpentine, or of petroleum to condense upon them than when they are placed directly in these liquids. (Mansfield, *loc. cit.*, p. 262.) Many are soluble in acetone, fusel-oil, hydride of valeryl, valerianic acid, valerate of amyl (Trautwein), caoutchin, creosote (Reichenbach), anilin (Hofmann), toluene (Pelletier & Walter), in concentrated acetic acid, mercur(*ic*) methyl, chloride of ethyl, picolin, from which solution they are separated when it is boiled with water (Unverdorben), water acidulated with oxyphenic acid (Buchner, *Ann. Ch. u. Pharm.*, **96.** 189); readily in caprylic alcohol (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 104), in chloroform, and the like. They are also soluble in liquid (condensed) sulphurous, and chlorhydric acids. (Faraday, *Ann. Ch. et Phys.*, (3.) **15.** 268.)

Acryl Resin.
α. Insoluble in a mixture of alcohol and ether.

Resin of Aloes. Insoluble in water. Easily soluble in alcohol, ether, and aqueous alkaline solutions, even lime-water.

Alouchi Resin(from *Wintera aromatica*). Contains two resins: —

α. Easily soluble in cold spirit.

β. Difficultly soluble in cold, more soluble in boiling spirit. Easily soluble in ether. Insoluble in soda-lye. (Bonastre.)

Ammoniac Resin(Gummy resinous exudation from *Dorema ammoniacum*). (*Resin of Gum Ammoniac.*) Gum ammoniac is itself partially soluble in water, alcohol, ether, vinegar, and aqueous solutions of the alkalies. The resin which it contains is soluble in alcohol, and in the fixed and volatile oils. When treated with ether a portion of it dissolves, while another portion remains insoluble in this menstruum. Soluble in dilute acetic acid (vinegar). Easily soluble in sulphuric acid, from which it is reprecipitated on the addition of water. Soluble in caustic alkaline solutions.

Anime Resin(from *Hymenæa courbaril*). (*Gum anime. Soft Copal. Resin of Courbaril.*) The rare variety of anime which formerly came from the East Indies is entirely soluble in oil of turpentine; but absolute alcohol dissolves only mere traces of it. That which is brought from South America is completely soluble in boiling alcohol, while cold alcohol separates it into its two component resins.

α) *an acid resin.* Soluble in cold alcohol and in oils.

β) *an indifferent resin.* Insoluble in cold, but soluble in hot alcohol. Soluble in oils.
$C_{40}\ H_{32}\ O_2$

Anime resin is only slightly soluble in liquid benzin, but is rapidly dissolved when the vapor of benzin is caused to condense upon it. With oil of turpentine it behaves in a similar manner. (Mansfield, *J. Ch. Soc.*, **1.** 261.)

Anthracoxene(fossil resin). Insoluble in spirit; but after having been exposed for a long time to the air it becomes partially soluble. Partially soluble in ether. (Reuss.)

Antiar Resin(from *Antiaris toxicaria*). Insoluble in water. Soluble in 325 pts. of alcohol at 20°, in 44 pts. of boiling alcohol, and in 1.5 pts. of boiling ether. Easily soluble in the essential oils. Very sparingly soluble in an aqueous solution of caustic potash.
$C_{32}\ H_{24}\ O_2$

Resin of *l'Arbre à Brai* [Arbol-a-brea] (*Canarium album*). *Vid.* Resin of Canarium.

Resin of Assafœtida. Soluble in spirit, from which it is precipitated on the addition of water. Soluble in concentrated sulphuric acid, from which it is reprecipitated by water.
$C_{40}\ H_{26}\ O_{10}$

According to Brandes, it is a mixture of two resins, the one soluble, the other insoluble in ether.

Resins of Benzoin(" Gum Benzoin "). (The concrete juice of *Styrax Benzoin.*) There are three different resins: —

$\alpha = C_{70}H_{42}O_{14}$ Readily soluble in alcohol, ether, and oil of cumin. Also soluble in potash-lye. Insoluble in an aqueous solution of carbonate of potash. Insoluble in naphtha or in ammonia-water.

$\beta = C_{30}H_{20}O_{5}$ Soluble in boiling alcohol, and in an aqueous solution of carbonate of potash. Insoluble in ether, or the essential oils, or in ammonia-water.

$\gamma = C_{40}H_{22}O_{9}$ Soluble in alcohol. Sparingly soluble in ether. Insoluble in naphtha.

Benzoin is insoluble in benzin, and in the other light coal-naphthas. (De la Rue.)

Resin of Birch Bark. Insoluble in water, (*Betulin.*) or in aqueous alkaline solutions. Soluble in 120 pts. of cold, and in 80 pts. of hot alcohol. Also soluble in ether, and in the fatty and essential oils. Soluble in strong sulphuric acid. (Wittstein's *Handw.*)

Resin of Calophyllum. *Vid.* Maynas Resin.

Resin of Ceradia(from *Ceradiu furcata*).

Canada Balsam(from *Abies balsamea*). (*Canadian Turpentine. Balsam of Fir.*) Contains about 40% of a resin soluble in alcohol; and 30% of a sub-resin difficultly soluble in alcohol. (Parrish's *Pharm.*, p. 352.)

Resin of Canarium(from *Canarium album*). (*Resine de l'Arbre à Brai.*) Three times as soluble in alcohol as Breane [from icica resin]. (Scribe, *Ann. Ch. et Phys.*, (3.) **13.** 170.)

The portion sparingly soluble in cold alcohol dissolves easily in boiling alcohol, and in ether. Baup has found that it contains four substances.

α.) *Amyrin.* Very sparingly soluble in cold water, or alcohol of 85%. Readily soluble in ether and in warm absolute alcohol.

β.) *Brein.* Insoluble in water. Soluble in 70 pts. of alcohol of 85% at 20°, and more easily in absolute alcohol. Easily soluble in ether.

γ.) *Bryoidin.* Soluble in 350 pts. of cold, and much more readily in boiling water. Very soluble in alcohol, ether, fatty and essential oils, alkaline solutions, &c.

δ.) *Breidin.* Soluble in 270 [260] pts. of water at 10°, and much more soluble in warm water. Easily soluble in alcohol; less soluble in ether.

Caranna Resin(from *Amyris Caranna*; also from *Bursera gummifera*). (*Gum Caranna. Resine de Gomart. Resine de Chibou. Resine de Cachibou.*)

Resin of Cascarilla(from the bark of *Croton Cascarilla*, &c). Consists of two resins: —

α = *indifferent resin.* Soluble in alcohol, and ether, and in hot oil of turpentine, and fatty oils. Insoluble in acids, excepting concentrated acetic acid, or in alkaline solutions.

β = *acid resin.* Soluble in alcohol. Insoluble in ether, or fatty or essential oils. Easily soluble in alkaline solutions. (Trommsdorff.)

Its compound with copper is insoluble in alcohol.

Resins of Cassia.
Resins of Cinnamon. } See Resins from Oil of Cinnamon.

Resins of Copaiba. Balsam Copaiba (the juice of *Copaifera officinalis, etc.*), contains from 31 to 80% of a volatile oil [see under Essences], 1.6% of a soft brown resin (β), and from 20 to 66% of an acid resin (α), called also Copaivic Acid (see below).

Balsam Copaiba itself is insoluble in water; but is entirely soluble in absolute alcohol, ether, and the fixed and volatile oils. It is completely dissolved by strong alkaline solutions, but the resulting solution becomes turbid when largely diluted with water. (*U. S. Dispensatory.*) Soluble in alcohol of 90%. (Parrish's *Pharm.*, p. 355.) It is soluble in ammonia-water.

I.) α, or *Copaivic Acid.* Insoluble in water. $C_{40}H_{30}O_{4}$ More soluble in warm than in cold concentrated alcohol. Easily soluble in ether, fatty and essential oils, and bisulphide of carbon. Easily soluble in ammonia-water, and in aqueous solutions of the fixed alkalies. Soluble in cold petroleum. (*U. S. Dispensatory.*)

Copaivate of Ammonia. Soluble in water and in alcohol.

Copaivate of Lead. Insoluble, or very sparingly soluble in alcohol. $C_{40}H_{29}PbO_{4}$

Copaivate of Lime. Soluble in alcohol, from which it is precipitated by water. $C_{40}H_{29}CaO_{4}$

Copaivate of Potash. Soluble in alcohol, and in alkaline solutions; by the addition of much water it is precipitated from the latter.

Copaivate of Silver. Sparingly soluble in alcohol. Easily soluble in ammonia-water. $C_{40}H_{29}AgO_{4}$

II.) Fehling has described a crystalline resin, $C_{40}H_{28}O_{6}$ oxycopaivic acid, from copaiba which differs from the preceding. It is insoluble in water. Very soluble in ether, less soluble in alcohol. Soluble in ammonia-water.

Its Lead Salt. Is a ppt. $C_{40}H_{27}PbO_{6}$

Its Potash Salt. Is soluble in water.

Its Silver Salt. Is a ppt. $C_{40}H_{27}AgO_{6}$

Its Soda Salt. Is soluble in water.

Posselt has described a sample of balsam copaiba which contained two uncrystallizable resins, the one soluble, the other insoluble in alcohol.

III.) β. Insoluble in cold petroleum. Easily soluble in absolute alcohol, and in ether. More soluble in ammonia-water than copaivic acid.

Copal(from several species of *Hymenœa*). Copal varies considerably in solubility as procured from different sources. In its natural state it is but sparingly soluble in absolute alcohol, but it becomes more soluble when exposed to the air in a state of fine powder during several weeks. As a rule, it is insoluble in spirit, but some varieties are dissolved when suspended in the vapor of boiling alcohol. In ether it first swells up, and then dissolves completely, the swollen mass is also readily soluble in boiling alcohol. Soluble in rectified oil of turpentine; but it is less readily soluble in oil of turpentine than in oil of rosemary, in which it is abundantly soluble. After having been melted, by which process it undergoes partial decomposition, it is much more readily soluble in alcohol and oil of turpentine. Only slightly soluble in liquid benzin, or oil of turpentine, but is rapidly dissolved by the vapors of these substances when these are condensed directly upon it. (Mansfield, *J. Ch. Soc.*, **1.** 261.) Unacted upon by anilin, or quinolein, even when melted beneath these liquids. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** pp. 143, 169.) "Soft" copal is very easily soluble in caprylic alcohol, and even "hard" copal swells up, and after a while dissolves in this liquid. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 104.) Insoluble in cold aqueous solutions of potash or ammonia; it combines with these alkalies when treated with boiling solutions, forming compounds soluble in pure water, but insoluble in liquids which are at all alkaline. (Filhol.) Several different varieties of resin have been distinguished in copal.

α. Soluble in alcohol of 72%, in ether, and in oil of turpentine. With alkalies it forms salts which are soluble in ether, but insoluble in alcohol, with the exception of the potash salt.

β. Soluble in all proportions in alcohol, ether, and oil of turpentine. With alkalies it forms salts soluble in ether, but insoluble in absolute alcohol.

γ. Soluble in absolute alcohol and in ether. Its alkaline salts are insoluble in alcohol or ether.

δ. Insoluble in alcohol or ether. Soluble in an alcoholic solution of potash.

ε. Insoluble in all the above-mentioned menstrua.

RESIN OF CORK. Soluble in ether. (Boussingault.) $C_{32}H_{26}O$

DAMMARA RESIN.

A.) *Ordinary*, or *East Indian Dammara Resin* (from *Dammara orientalis*). Only partially soluble in absolute alcohol, or in alkaline solutions; more easily soluble in ether; and still more easily in ethereal or fatty oils. According to Brandes, it contains 2 resins. $C_{16}H_{13}O$

α (*of which it contains* 83%). Easily soluble in alcohol, and ether.

β (*of which it contains* 17%). Soluble in 1000 pts. of absolute alcohol; and in 40 @ 50 pts. of ether. Insoluble in alkaline solutions. (*Dammarin.*)

According to Dulk, it is partially soluble in alcohol, and ether. Completely soluble in oils and in sulphuric acid; also soluble, with decomposition, in nitric acid; difficultly attacked by alkaline solutions; and contains 5 different resins.

I.) *Dammaryl* or *δ resin.* Soluble in ether. Insoluble in spirit. $C_{46}H_{38}$

II.) *α* (*constitutes some 24% of the whole*). Soluble in cold dilute alcohol. $C_{46}H_{39}O_4$

III.) *β* (*10% of the whole*). Soluble in hot, insoluble in cold dilute alcohol.

IV.) *γ* (*44% of the whole*). Insoluble in dilute spirit, either hot or cold. Soluble in absolute alcohol, ether, oils, and sulphuric acid. (*Dammarylic Acid.*) $C_{46}H_{38}O_3$

V.) *ε* (*7% of the whole*). Insoluble in ether, or in alkaline solutions. Soluble in oil of turpentine. $2C_{46}H_{38}+HO$

B.) *Australian Dammara Resin* (from *Dammara Australis*). Only partially soluble in common alcohol; but is completely soluble in absolute alcohol, and in oil of turpentine. (R. D. Thomson.) (*Cowdie Gum.*) $C_{40}H_{31}O_6$

It is composed of Dammaric Acid, and Dammarane, *q. v.*

DISACRYL RESIN. Insoluble in water. Soluble in alcohol, from which it is precipitated on the addition of water. Also soluble in ether, and in aqueous solutions of the caustic alkalies. $C_{20}H_{13}O_6$

DRAGON'S BLOOD. (Resinous substance from the fruit of various species of *Calamus*.) Insoluble in water. Soluble in alcohol, ether, and the fixed and volatile oils. It contains about 90% of a resin which has been called Draconin. (*Sanguis Draconis.*)

ELEMI RESIN (from *Amyris zeylanica*). Contains two resins. (*Resin of Icica, q. v.*)

α = *crystalline.* Completely soluble in boiling concentrated alcohol, from which it separates out as the solution cools. $C_{40}H_{32}O_2$

β = *amorphous, acid resin.* Very readily soluble in cold alcohol.

RESIN OF EUPHORBIUM (from various species of *Euphorbia*). Contains 3 different resins.

I.) *crystalline.* Insoluble in cold, soluble in hot alcohol. $C_{40}H_{30}O_6$

II.) *amorphous.* Easily soluble in cold alcohol.

III.) Difficultly soluble in cold alcohol.

FICHTELITE (*fossil resin from Bavaria*). Soluble in alcohol, and ether. $C_{80}H_{70}$''

FICHTELITE with OXIDE OF LEAD. Insoluble in ether.

BromoFichtelite. $C_{80}H_{69}Br$
*Bi*BromoFichtelite. $C_{80}H_{68}Br_2$
*Bi*ChloroFichtelite. $C_{80}H_{68}Cl_2$
*Quadri*ChloroFichtelite. $C_{80}H_{68}Cl_4$

Soluble in alcohol, and ether. (T. E. Clark, *Am. J. Sci.*, (2.) **25.** pp. 164 – 176.)

FOSSIL RESIN OF GIRON (New Granada). Insoluble in alcohol. Swells up in ether. (Boussingault, *Ann. Ch. et Phys.*, (3.) **6.** 507.)

RESIN OF GAMBOGE (or *Gummi Gutta*). Insoluble in water. Very soluble in ether; less soluble in alcohol. Soluble in warm ammonia-water, from which it is precipitated on the addition of carbonate of ammonia. It forms salts

with BARYTA.

with LEAD.

with POTASH. Soluble in water, and in absolute alcohol.

with SODA. Insoluble in an aqueous solution of chloride of sodium.

GILEAD, BALSAM OR BALM OF (Resinous juice of *Amyris Gileadensis*). (*Baume de la Mecque, Judea, ou Cairo.*)

Contains:

I.) A resin soluble in water[?] and in fatty and essential oils, but insoluble in alcohol.

II.) A resin, difficultly soluble in cold, more easily soluble in hot alcohol and ether. Also soluble in the fatty and essential oils.

III.) An essential oil soluble in alcohol, and ether, also in concentrated sulphuric acid, from which it is precipitated on the addition of water.

RESINE DE GOMART. *Vid.* Caranna Resin.

RESIN OF GUAIACUM (from *Guaiacum officinale*). Guaiacum or "gum guaiac" is itself partially dissolved by water, about 9% of it being soluble therein. It is en- (*Guaiacin.*)

tirely soluble in alcohol of 83%. It is also soluble in ether, in alkaline solutions, in strong sulphuric acid, and in "nitrous ether" (solution of nitrite of ethyl in alcohol). The resin which it contains is insoluble in water. Alcohol dissolves about $\frac{9}{10}$ of this resin; ether dissolves somewhat less. Soluble in oil of turpentine, best when hot, insoluble in fatty oils. Soluble in concentrated sulphuric acid, and in an aqueous solution of caustic potash. Pelletier says that ammonia-water dissolves $\frac{9}{10}$ of the entire resin. Unverdorben, on the other hand, states that this resin contains two different resins, one of which is very soluble in ammonia-water, while the other forms with ammonia a tarry compound, which is soluble in 6000 pts. of water.

Gum guaiacum is insoluble in benzin, or the other light coal-naphthas. (De la Rue.)

RESINS OF GUTTA-PERCHA.

α = Pure *Gutta, q. v.*

β = *White resin.* (*Alban.*) Very soluble in boiling, less soluble in cold absolute alcohol. Very soluble in oil of turpentine, benzin, ether, chloroform, and bisulphide of carbon. Unacted upon by concentrated chlorhydric acid or by weak acids; decomposed by concentrated sulphuric and nitric acids. Unacted upon by boiling alkaline solutions.

γ = *Yellow resin.* Soluble in cold alcohol, ether, benzin, oil of turpentine, bisulphide of carbon and chloroform. Unacted upon by alkaline solutions, ammonia-water, weak acids, or concentrated chlorhydric acid. Decomposed by concentrated sulphuric, and nitric acids. (Payen.)

RESIN OF ICICA(from various plants of the family *Icica*). Insoluble in water. Soluble in 55 pts. of cold, and in 15 pts. of boiling alcohol of 36%. Soluble in 3.5 pts. of oil of turpentine at the ordinary temperature. In the cold, the action of these solvents is very slow. "Of all the resins this is the least soluble in alcohol." (Scribe, *Ann. Ch. et Phys.*, (3.) **13.** 167.) It contains three different resins.

α = "*Breane.*" $C_{40} H_{32} O_2$ Insoluble in water, or in alkaline solutions. Soluble in 100 pts. of alcohol at the ordinary temperature, being less soluble therein than either β or γ. Ether dissolves 4.35 pts. of it. Soluble in concentrated sulphuric acid. (Scribe, *loc. cit.*, p. 169.)

β = "*Icacine.*" $C_{40} H_{34} O_2$ Soluble in 50 pts. of cold alcohol, but less soluble than γ in alcohol. In ether it is as soluble as α. (Scribe, *loc. cit.*)

γ = *amorphous resin.* (*Icica Colophany.*) $C_{40} H_{30} O_4$ Easily soluble in alcohol, and ether, being much more soluble than either α or β. Insoluble in alkaline solutions. (Scribe.)

RESIN OF JALAP(from *Convolvulus schiedeanus*). (*Jalapin* (of commerce).) Soluble in alcohol. Insoluble in fixed oils, oil of turpentine, or ether. When powdered and thrown into cold water it does not dissolve, but forms a semifluid mass as if it had been melted. Soluble in acetic acid, from which it is precipitated on the addition of much water. (Parrish's *Pharm.*, pp. 189, 190.)

It contains two different resins:

α = "*Para Rhodeoretin.*" $C_{40} H_{34} O_{18}$(?) Soluble in alcohol and ether, in concentrated sulphuric acid, with decomposition, and in aqueous solutions of the caustic alkalies. Insoluble even in warm chlorhydric, nitric, and acetic acids.

β = *Resin insoluble in ether.* *Vid.* Convolvulin. (*Rhodeoretin. Jalapin.*) $C_{62} H_{50} O_{32}$

LAC. (*Shellac. Gum Shellac. Stick Lac. Seed Lac.*) Insoluble in water. Almost entirely soluble in alcohol, especially if this be warm. Soluble in ordinary spirit, and as a rule, in wood-spirit, but some samples of the latter dissolve it only imperfectly, wood-spirit being a mixed and very variable product. Sparingly soluble in lignone. (Graham, *et al.*, *J. Ch. Soc.*, **8.** 133.) Sparingly soluble in benzin, but a saturated solution of shellac in alcohol or wood-spirit is miscible with an equal volume of benzin. (Mansfield, *J. Ch. Soc.*, **1.** 260.) Partially soluble in ether and the volatile oils. Soluble in chlorhydric and acetic acids, and in aqueous solutions of potash and soda. According to Unverdorben, there are 5 different resins in lac.

I.) Soluble in alcohol, and ether.

II.) Soluble in alcohol. Insoluble in ether.

III.) Sparingly soluble in cold alcohol.

IV.)

V.) Insoluble in naphtha. Soluble in alcohol, and ether.

The coloring matter of lac is soluble in alkaline solutions, but its best solvent is concentrated sulphuric acid.

LABDANUM(Resinous substances from various species of *Cistus*). (*Ladanum.*) Soluble in alcohol.

RESINS OF MADDER.

α. Sparingly soluble in boiling water, from which it is precipitated on the addition of acids. Easily soluble in alcohol. Soluble in aqueous solutions of the caustic and carbonated alkalies, also in concentrated sulphuric acid, from which it is precipitated on the addition of water. Decomposed by boiling concentrated nitric acid.

β. Sparingly soluble in boiling water, from which it is precipitated on the addition of acids. Soluble in boiling, less soluble in cold alcohol. Soluble in aqueous solutions of the caustic and carbonated alkalies, and in concentrated sulphuric acid, from which it is precipitated on the addition of water. (Schunck, *Rep. Br. Assoc.*, 1848, p. 68.)

MASTICH(Resinous exudation of *Pistacia lentiscus*). Insoluble in water. Alcohol dissolves about $\frac{4}{5}$ of it. Completely soluble in ether, and oil of turpentine. Scarcely at all soluble in the fixed oils. Largely soluble in benzin. (Mansfield, *J. Ch. Soc.*, **1.** 261.) It contains two resins: —

α = $C_{40} H_{31} O_4$ Soluble in cold alcohol.

β = $C_{40} H_{31} O_2$ (*Masticin.*) Insoluble in cold, soluble in hot alcohol. In cold alcohol it softens and swells up.

RESIN OF MAYNAS(a province in South America). (*Resina Calophylli*(from *Calophyllum longifolium*).) $C_{28} H_{18} O_8$ Insoluble in water. Very soluble in alcohol, ether, and the fatty and essential oils; also soluble in acetic acid, even in the cold, and in concentrated sulphuric acid, from which water precipitates it unchanged. Easily soluble in aqueous solutions of caustic potash, soda, and ammonia, even in the cold. (Lewy, *Ann. Ch. et Phys.*, (3.) **10.** 382.)

MIDDLETONITE(Resin which occurs in coal at

Middleton). Scarcely at all soluble in alcohol, ether, or oil of turpentine.

Resins from Oil of Cinnamon.

I.) *Resins formed by the action of the air.* There are two of these resins, both insoluble in water, but soluble in boiling alcohol.

$\alpha = C_{30} H_{15} O_4$ Easily soluble in cold alcohol, from which it is precipitated on the addition of acetic acid. Easily soluble in ether, oil of turpentine, and olive-oil. Slowly soluble in a boiling aqueous solution of caustic potash. At 25°, it is soluble in concentrated sulphuric acid, from which it is precipitated unchanged on the addition of water. Insoluble in ammonia-water, or in concentrated chlorhydric acid. (Mulder.)

$\beta = C_{12} H_5 O$ Readily soluble in hot, very little soluble in cold alcohol. Readily soluble in ether. Scarcely at all soluble in an aqueous solution of caustic potash. Insoluble in ammonia-water. Soluble, without change, in concentrated chlorhydric and sulphuric acids; from this solution it is precipitated unchanged on the addition of water. (Mulder.)

II.) *Resins formed by the action of nitric acid upon oil of cinnamon.* There are two of these resins; both of them insoluble in water, but soluble in boiling alcohol.

$\alpha = C_{18} H_7 O_5$ Soluble in alcohol, and ether, in an aqueous solution of caustic potash, and in cold concentrated sulphuric acid. Insoluble in ammonia-water. (Mulder.)

$\beta =$ Soluble in boiling, less soluble in cold alcohol. (Mulder.)

III.) *Resins formed by the action of concentrated sulphuric acid upon oil of cinnamon.*

$\alpha = C_{30} H_{15} O_2$ Soluble in cold alcohol, in ether, oil of turpentine, and olive-oil; also in warm concentrated sulphuric acid. Insoluble in boiling chlorhydric acid, or in boiling aqueous solutions of caustic potash, or ammonia. (Mulder.)

$\beta = C_{30} H_{15} O_2$ Insoluble in boiling alcohol. Easily soluble in cold ether; also soluble in oil of turpentine, olive-oil, and concentrated sulphuric acid, when this is gently heated. Insoluble in boiling chlorhydric acid, or in boiling aqueous solutions of caustic potash or ammonia. (Mulder.)

IV.) *Resins produced by the action of chlorhydric acid upon oil of cinnamon.*

$\alpha = C_{14} H_6 O$ Easily soluble in cold alcohol, and in ether; also soluble in oil of turpentine, and in olive-oil. Soluble in cold concentrated sulphuric acid. Insoluble in boiling chlorhydric acid, or in aqueous solutions of caustic potash or ammonia.

$\beta = C_{20} H_8 O$ Insoluble in cold, and but sparingly soluble in boiling alcohol. Readily soluble in ether, oil of turpentine, and olive-oil. Soluble in concentrated sulphuric acid at a temperature of 50°. Insoluble in boiling chlorhydric acid, or in aqueous solutions of caustic potash or ammonia.

V.) *Resin formed by the action of ammonia upon oil of cinnamon.* Insoluble in cold, soluble in boiling alcohol. Soluble in ether, in boiling aqueous solutions of caustic potash or ammonia, and in concentrated sulphuric acid, from which it is precipitated unchanged on the addition of water. Insoluble in boiling chlorhydric acid. (Mulder.)

$C_{14} H_6 O$

Resin of the Olive-Tree

Contains: —

I.) A resin soluble in warm, but almost insoluble in cold alcohol. Soluble in warm ether.

II.) A resin sparingly soluble in ether; readily soluble in cold alcohol.

III.) A gum, sparingly soluble in water. Insoluble in alcohol, or ether.

IV.) Olivil, *q. v.*

Resin of Opium. Insoluble in water, or ether. Easily soluble in alcohol, and in aqueous solutions of the alkalies. (Pelletier.)

$C_{32} H_{23} N O_{12}$

Resin of Opoponax (from *Pastinica opoponax*). Easily soluble in alcohol, and ether. Also soluble in aqueous solutions of the caustic alkalies.

$C_{40} H_{24} O_{14}$

Balsam Peru (from *Myrospermum peruiferum*). Insoluble in water. Completely soluble in strong alcohol. Partially soluble in ether, and in the fatty and essential oils.

Resin of the Pitch-Tree. *Vid.* Resin of Canarium.

Resin of Podophyllum. Insoluble in water, or oil of turpentine. Partially soluble in alcohol, also partially soluble in ether, — one of its component resins being insoluble therein. Soluble, with combination, in aqueous solutions of the caustic alkalies. (Parrish's *Pharm.*, p. 191.)

(*Podophyllin*(of commerce).)

Resin of Sagepenum (from *Ferula persica*).

(*Gum Seraphic.*)

$C_{40} H_{29} O_9$

Sandarach (from *Thuya articulata, &c.*). Contains several different resins: — As a whole, it dissolves easily and completely in absolute alcohol, and in warm spirit of 80%. Cold spirit leaves about $\frac{1}{5}$ of it undissolved (Giese), but this residue ("sandaracin") is soluble in ether, and in oil of turpentine. Soluble in acetone, and in wood-spirit which contains acetone. Soluble, with combination, in alkaline solutions.

$\alpha = C_{40} H_{31} O_5$ Difficultly soluble in alcohol.

$\beta = C_{40} H_{31} O_6$ Easily soluble in cold alcohol.

$\gamma = C_{40} H_{30} O_6$ Soluble in boiling alcohol.

Scammony Resin. Insoluble in water. Soluble in alcohol, and ether. Almost entirely insoluble in oil of turpentine. Soluble in alkaline solutions, with decomposition.

$C_{60} H_{54} O_{26}$

Resin of Styrax or Storax. *Vid.* Styracin.

Resins from Balsam of Tolu.

$\alpha = C_{36} H_{18} O_8$ Easily soluble in cold alcohol, and ether. Soluble in alkaline solutions, and in cold concentrated sulphuric acid, with subsequent decomposition. (E. Kopp, *Ann. Ch. et Phys.*, (3.) **20.** 381.)

$\beta = C_{36} H_{20} O_{10}$ Sparingly soluble in alcohol, and ether. Soluble in alkaline solutions, and in cold concentrated sulphuric acid. (E. Kopp, *loc. cit.*)

Resins of Turpentine. Contains three isomeric modifications: —

(*Ordinary Rosin. Colophany.*)

$C_{40} H_{30} O_4$

$\alpha =$ *Pinic Acid.* Insoluble in water. Soluble in alcohol, wood-spirit, ether, naphtha, and the fixed and essential

(*Amorphous Colophany Resin. Amorphous Pimaric Acid.*)

oils. This is the most soluble in cold weak spirit of any of the resins of turpentine. Also soluble in aqueous alkaline solutions.

The salts of pinic acid are less soluble in alcohol than those of sylvic acid.

β = *Sylvic Acid.* (*Crystalline Colophany Resin. PyroMaric Acid.*) Insoluble in water. Less soluble than the preceding in cold spirit. Readily soluble in hot spirit. Soluble in 8 @ 10 pts. of alcohol. Very soluble in ether. Also soluble in concentrated acetic acid, in wood-spirit, naphtha, in oil of turpentine, and the oils generally. Soluble in ammonia-water, but its potash-salt is insoluble in an aqueous solution of caustic potash. The sylvates are soluble in ether and in absolute alcohol.

γ.) *Pimaric Acid.* (Probably identical with Sylvic Acid. *Vid. Liebig & Kopp's Jahresbericht*, **1.** 572, *note.*) Insoluble in water. The crystallized acid is soluble in 10 pts. of alcohol at 18°, and in 1 pt. of boiling alcohol. Very soluble in ether. After pimaric acid has been fused it quickly dissolves in its own weight of alcohol at 18°, but in the course of a few moments it crystallizes out of this solution, and cannot now be redissolved in less than 10 pts. of the same alcohol. (Laurent, *Ann. Ch. et Phys.*, (3.) **22.** 461.)

Cailliot divides rosin into constituents which do not appear to be exactly equivalent to those mentioned above; his *Abietic Acid* (which may be identical with Pinic Acid(α)), is soluble in all proportions in alcohol, ether, and naphtha. Water precipitates it from the first two solutions, but not from the last. The salts of this acid will be given below, with the pinates. (Cailliot, *J. de Pharm.*, 1830, **16.** 438.) The *Abietic Acid* of Baup, which is stated to be soluble in 7.5 pts. of alcohol, of 0.88%, at 14°, is thought to be identical with Sylvic Acid(β) by Gerhardt (*Tr.*, **3.** 656, *note.*) Cailliot's *Abietin* (possibly identical with Sylvic Acid) is insoluble in water, or in cold alkaline lyes. Very soluble in alcohol at 34°. Soluble, in all proportions, in boiling alcohol, in ether, naphtha, and concentrated acetic acid. His "*Insoluble Neutral Resin*" is insoluble in cold alcohol of 40°, in naphtha, in alkaline lyes, &c. (*Loc. cit.*)

Rosin, as such, is insoluble in water. Easily soluble in alcohol, ether, wood-spirit, benzin, oil of turpentine, and the other essential oils; sparingly in lignone, partially in naphtha.

It is soluble in anilin, and quinolein. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** pp. 143, 169.)

Compare the general remarks upon RESINS.

In the following list the salts of each of the several modifications of rosin are classed together, as Resinates (α, β, & γ), under the name of the base. Most of them are soluble in ether; some are soluble in alcohol, and a few dissolve in water.

RESINATE OF ALUMINA.

I.) α or *Pinate.* Insoluble in water, or alcohol. Soluble in ether.

RESINATE OF AMMONIA.

I.) α or *Pinate?* Abietate (pinate ?) of ammonia is soluble in water. (Cailliot, *J. de Pharm.*, 1830, **16.** 439.)

II.) β or *Sylvate.* Soluble in 200 pts. of cold water. Very soluble in alcohol, and ether. (T.)

III.) γ or *Pimarate.* Soluble in alcohol.

RESINATE OF BARYTA.

I.) α or *Pinate.* Sparingly soluble in water. Insoluble in alcohol. Readily soluble in ether. Abietate(pinate ?) of baryta is insoluble in water, and only sparingly soluble in cold alcohol; it is decomposed by boiling alcohol of 40°. (Cailliot, *J. de Pharm.*, 1830, **16.** 439.)

II.) β or *Sylvate.* Soluble in boiling absolute alcohol.

RESINATE OF COBALT.

I.) α or *Pinate.* Soluble in ether.

RESINATE *of protoxide* OF COPPER.

I.) α or *Pinate.* Insoluble in water. Very sparingly soluble in absolute alcohol. Very soluble in ether, oil of turpentine, and the fatty oils.

II.) β or *Sylvate.* Soluble in alcohol.

RESINATE *of protoxide* OF IRON.

I.) α or *Pinate.* Readily soluble in ether.

II.) β or *Sylvate.* Readily soluble in ether.

RESINATE *of sesquioxide* OF IRON.

I.) α or β. Sparingly soluble in water. Readily soluble in ether.

RESINATE OF LEAD.

I.) α or *Pinate.* Insoluble in alcohol. Sparingly soluble in ether. Soluble in oil of turpentine, and the fatty oils.

II.) β or *Sylvate.* Insoluble in alcohol.

III.) γ or *Pimarate.* Partially soluble in an aqueous solution of caustic potash.

RESINATE OF LIME.

I.) α or *Pinate.* Sparingly soluble in water, and alcohol. Readily soluble in ether, and oil of turpentine. Abietate(pinate ?) of lime resembles the baryta salt. (Cailliot, *J. de Pharm.*, 1830, **16.** 439.)

II.) β or *Sylvate.* Soluble in absolute alcohol.

RESINATE OF MAGNESIA.

I.) α or *Pinate.* Sparingly soluble in water. Insoluble in alcohol. Readily soluble in ether. Abietate(pinate ?) of magnesia resembles the baryta salt. (Cailliot, *J. de Pharm.*, 1830, **16.** 439.)

II.) β or *Sylvate.* Readily soluble in alcohol, ether, and oil of turpentine.

RESINATE OF MANGANESE.

I.) α or *Pinate.* Insoluble in water, or alcohol. Soluble in ether.

II.) β or *Sylvate.* Readily soluble in absolute alcohol.

RESINATE *of dinoxide* OF MERCURY.

I.) α or *Pinate.* Soluble in ether.

RESINATE *of protoxide* OF MERCURY.

I.) β or *Sylvate.* Soluble in ether.

RESINATE OF MORPHINE.

I.) α or *Pinate?* Abietate(pinate ?) of morphine is insoluble in water. Soluble in alcohol, and ether. (Cailliot, *J. de Pharm.*, 1830, **16.** 439.)

RESINATE OF NICKEL.

I.) α or *Pinate.* Readily soluble in ether, and oil of turpentine.

RESINATE OF POTASH.

I.) α or *Pinate.* Soluble in water, and alcohol. Insoluble in oil of turpentine, or olive-oil, or in an excess of an aqueous solution of caustic potash.

Abietate(pinate ?) of potash is soluble in all proportions in cold water and in strong alcohol. (Cailliot, *J. de Pharm.*, 1830, **16.** 438.)

II.) β or *Sylvate.* Sparingly soluble in water, and cold alcohol. Tolerably soluble in boiling alcohol. (Unverdorben.)

III.) γ or *Pimarate.* Soluble in alcohol.

Resinate of Quinine.

I.) α or *Pinate?* Abietate(pinate ?) of quinine is insoluble in water. Easily soluble in alcohol, and ether. (Cailliot, *J. de Pharm.*, 1830, **16**. 439.)

Resinate of Silver.

I.) α or *Pinate.* Insoluble in water. Very sparingly soluble in absolute alcohol. Readily soluble in ether, and oil of turpentine.

II.) β or *Sylvate.* Sparingly soluble in alcohol. Soluble in ammonia-water.

III.) γ or *Pimarate.*

Resinate of Soda.

I.) α or *Pinate.* Soluble in water, and alcohol. Abietate(pinate ?) of soda is soluble in water like the potash-salt. (Cailliot, *J. de Pharm.*, 1830, **16**. 439.)

II.) β or *Sylvate.*

III.) γ or *Pimarate.* Soluble in alcohol.

Resinate of Strontia.

I.) α or *Pinate.* Abietate(pinate ?) of strontia resembles the baryta-salt. (Cailliot, *J. de Pharm.*, **16**. 439.)

Resinate *of binoxide* of Tin.

I.) α or *Pinate.* Insoluble in water, oil of turpentine, or the fatty oils. Partially soluble in alcohol, and ether.

Resinate of Zinc.

I.) α or *Pinate.* Insoluble in water, or alcohol. Soluble in ether.

II.) β or *Sylvate.* Soluble in alcohol.

Resins formed by the action of nitric acid upon oil of turpentine.

A = $C_{40} H_{24} O_{20}$ Insoluble in cold, sparingly soluble in boiling alcohol. Insoluble in aqueous solutions of caustic potash, or ammonia. (Cailliot, *Ann. Ch. et Phys.*, (3.) **21**. 36.)

B = $C_{40} H_{24} O_{10}$ Soluble in dilute cold alcohol. Insoluble in ammonia-water, or in alkaline lyes. (Cailliot, *loc. cit.*)

C = $C_{40} H_{24} O_{16}$ Soluble in alcohol, in ammonia-water, and in alkaline liquors. (Cailliot, *loc. cit.*)

Resin of Xanthorea(from *Xanthorrhea hostilis*, from environs of Sydney). Insoluble in water. Easily soluble in alcohol, and ether. Also soluble in solutions of caustic alkalies.
$C_{40} H_{20} O_{12}$

Resinein(of Fremy).
$C_{20} H_{15} O$

Resineone(of Fremy). Easily soluble in alcohol.
$C_{29} H_{23} O$

Resinoin(of Fremy). Insoluble in water. Almost insoluble in alcohol. Easily soluble in ether.
$C_{20} H_{15} O$

Resinone(of Fremy). Insoluble in water. Soluble in alcohol, and ether.
$C_{10} H_9 O$

Retinaphtha. *Vid.* Hydride of Toluenyl.

RetinAsphaltum. Unacted upon by water. Partially soluble in alcohol, potash-lye, and nitric acid. (Hatchett.)

Retinic Acid. Soluble in alcohol, and ether. (Johnston.)
$C_{21} H_{14} O_3$

Retinyl. *Vid.* Cumene.

Retinol. Unacted upon by alkaline solutions.
(*Retinolin.*)
$C_{64}H_{32}$''

Retisterene. *Vid.* MetaNaphthalin.

Rhamnin(from *Rhamnus frangula*). Perhaps identical with Chrysorhamnin.

Very sparingly soluble or insoluble in cold water. Swells up in boiling water. Insoluble in cold, easily soluble in boiling alcohol. Insoluble in ether. Soluble in aqueous solutions of the caustic and carbonated alkalies. Also in concentrated chlorhydric, and sulphuric acids, from which solutions it is precipitated on the addition of water.

RhamnoTannic Acid. Almost insoluble in cold, somewhat soluble in boiling water. Readily soluble in alcohol, and ether. Soluble in aqueous solutions of caustic ammonia, potash, and lime. (Binschwanger.)

RhamnoXanthin. *Vid.* Frangulin.

Rheadic Acid(from *Papaver rhœas*).
(*Rhœadic Acid. Papaveric Acid.*)

Rhodallin. *Vid.* Thiosinnamin.

Rhodeoretic Acid. *Vid.* Convolvulic Acid.

Rhodeoretinolic Acid. *Vid.* Convolvulinolic Acid.

Rhodiate of Ammonia. Readily soluble in chlorhydric acid. (Berzelius.)

Rhodiate of Lime.

Rhodiate of Potash. Soluble in nitric and chlorhydric acids, also in an aqueous solution of caustic potash. (Descotils.)

Rhodiate of Soda.

Rhodanide of *X*. *Vid.* SulphoCyanide of *X*.

RhodiCyanide of Potassium. Resembles Iridicyanide of Potassium, *q. v.* (Claus, *Beiträge*, p. 96.)
$C_{12} N_6 Rh_2 K_3 = 3 K Cy, Rh_2 Cy_3$

Rhodium. Insoluble in nitric or chlorhydric acid, in dilute sulphuric acid, or even in aqua-regia. (H. Rose, *Tr.*) Scarcely soluble in any acid. When alloyed with bismuth, lead, copper, or platinum, it is soluble in aqua-regia; but it is not soluble therein when combined with gold or silver. (Wollaston.)
Rh

Rhodizonic Acid. Readily soluble in water, alcohol, and ether. (Heller.)

The alkaline rhodizonates are soluble in water; those of the alkaline earths are in part soluble, while others are difficultly soluble, or insoluble; most of those of the metals proper are insoluble in water.

Rhodizonate of Alumina. Insoluble in water. (Berzelius's *Lehrb.*, **3**. 480.)

Rhodizonate of Ammonia. Readily soluble in water. Sparingly soluble in alcohol. (Heller.)

Rhodizonate of Baryta. Insoluble in water, alcohol, or ether. (Heller.) Sparingly soluble in strong acetic acid. (Werner.)

Rhodizonate of Bismuth. Ppt.

Rhodizonate of Cerium. Easily soluble in water, and alcohol. (Heller.)

Rhodizonate of Cobalt. Soluble in water, and alcohol.

Rhodizonate *of protoxide* of Copper. Ppt. Slightly soluble in water.

Rhodizonate of Glucina. Readily soluble in water, and alcohol. (Heller.)

Rhodizonate *of protoxide* of Iron. Soluble in water, and alcohol. (Heller.)

Rhodizonate *of sesquioxide* **of Iron.** Soluble in water, and alcohol.

Rhodizonate of Lead. Insoluble in water, or alcohol. (Heller.)

Rhodizonate of Lime. Soluble in water. Insoluble in alcohol. (Heller.)

Rhodizonate of Lithia. Soluble in water, with subsequent decomposition.

Rhodizonate of Magnesia. Easily soluble in water, and alcohol. (Heller.)

Rhodizonate of Manganese. Soluble in water, and alcohol.

Rhodizonate *of dinoxide* **of Mercury.** Insoluble in water, or alcohol.

Rhodizonate *of protoxide* **of Mercury.** Insoluble in water.

Rhodizonate of Nickel. Soluble in water, and alcohol.

Rhodizonate of Potash. Permanent. Easily soluble in water. (Gerhardt's *Tr.*) Sparingly soluble in cold, scarcely more soluble in hot water. Insoluble in alcohol, or ether. (Berzelius's *Lehrb.*) The aqueous solution gradually undergoes decomposition on standing.

Rhodizonate of Silver. Very sparingly soluble in water.

Rhodizonate of Soda. Soluble in water. Insoluble in alcohol. (Heller.)

Rhodizonate of Strontia. Sparingly soluble in water. Insoluble in alcohol. (Heller.)

Rhodizonate *of binoxide* **of Tellurium.** Soluble in alcohol.

Rhodizonate *of protoxide* **of Tin.** Sparingly soluble in water. Insoluble in alcohol. (Heller.)

Rhodizonate of Titanium.

Rhodizonate of Uranium. Easily soluble in water, and alcohol.

Rhodizonate of Zinc. Soluble in water, and alcohol. (Heller.)

Rhodizonate of Zirconia. Easily soluble in water, and alcohol.

RhodoTannic Acid. Soluble in water.
$C_{28}H_{12}O_{14} = C_{28}H_{10}O_{12}, 2HO$

RhodoTannate of Lead. Ppt.

RhodoTannate of Tin(SnO_2). Ppt.

RhodoXanthin.
$C_{28}H_{14}O_{10}$

Rhoeadinic Acid(from *Papaver rhoeas*). Somewhat hygroscopic. Easily soluble in water, and alcohol. Insoluble in ether. (Leo Meier.)

RhusTannic Acid. Soluble in water.

RhusTannate of Lead. Ppt.
$C_{18}H_{14}Pb_2O_{15}$

RicinElaidic Acid. Insoluble in water. Soluble in all proportions in strong alcohol, and in ether. Soluble in 5 pts. of alcohol of 22° (B ?), at the temperature of 50° (C.).
(Palmic Acid. Isomeric with Ricinolic Acid.)
$C_{36}H_{34}O_6 = C_{36}H_{33}O_5, HO$

Only the alkaline ricinelaidates are soluble in water, but some of the others are soluble in alcohol.

RicinElaidate of Ammonia.

RicinElaidate of Baryta. Ppt.
$C_{36}H_{33}BaO_6$

RicinElaidate of Copper. Sparingly soluble in boiling alcohol of 40%.

RicinElaidate of Ethyl. Tolerably soluble in cold, readily soluble in boiling alcohol.
$C_{36}H_{33}(C_4H_5)O_6$

RicinElaidate of Glyceryl. *Vid.* RicinElaidin.

RicinElaidate of Lead. Soluble in boiling alcohol.

RicinElaidate of Lime. Very sparingly soluble in alcohol.

RicinElaidate of Magnesia. Soluble in alcohol, especially if this be warm.

RicinElaidate of Potash. Soluble in water, and alcohol. The aqueous solution is decomposed by much water, with separation of an acid salt.

RicinElaidate of Silver. Insoluble in water or alcohol. Soluble in ammonia-water. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 85.) Insoluble in ether.
$C_{36}H_{33}AgO_6$

RicinElaidate of Soda.

I.) *normal.* Soluble in water, and alcohol. Decomposed by much water; free alkali remaining in solution, while an acid salt separates.

II.) *acid.* Soluble in water, and alcohol.

RicinElaidin. Insoluble in water. 100 pts. of alcohol of 36° (B ?) dissolve 50 pts. of it at the temperature of 30° (C.). Very soluble in ether.
(Palmin.)
$C_{78}H_{72}O_{14}$

Ricinolamid. Insoluble in water. Soluble in alcohol, and ether. Decomposed by acids. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 96.)
$N\left\{\begin{matrix}C_{36}H_{33}O_4\\H_2\end{matrix}\right.$

Ricinolic Acid. Insoluble in water. Miscible in all proportions with alcohol, and ether.
(Elaiodic Acid. Isomeric with RicinElaidic Acid.)
$C_{36}H_{34}O_6 = C_{36}H_{33}O_5, HO$

The metallic salts of ricinolic acid are soluble in alcohol, and some of them are also soluble in ether.

Ricinolate of Ammonia. Soluble in water.

Ricinolate of Baryta. Sparingly soluble in cold water, and alcohol. Very soluble in warm alcohol. Soluble in ammonia-water. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 100.)
$C_{36}H_{33}BaO_6$

Ricinolate of Ethyl. Insoluble, or very sparingly soluble in water.
$C_{36}H_{33}(C_4H_5)O_6$

Ricinolate of Lead. Easily soluble in ether.
$C_{36}H_{33}PbO_6$

Ricinolate of Lime.
$C_{36}H_{33}CaO_6$

Ricinolate of Magnesia. Readily soluble in alcohol.
$C_{36}H_{33}MgO_6$

Ricinolate of Silver. Insoluble in water. Very sparingly soluble in cold, easily soluble in warm alcohol. Very sparingly soluble in ether. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 100.) Sparingly soluble in hot alcohol or ether, with partial decomposition.
$C_{36}H_{33}AgO_6$

Ricinolate of Soda. Soluble in water. Insoluble in an aqueous solution of chloride of sodium. (Bouis.)

Ricinolate of Strontia. Soluble in hot, less soluble in cold alcohol.
$C_{36}H_{33}SrO_6$

Ricinolate of Zinc.

Rivulin(from *Rivula tubulosa*). Permanent. Forms a slimy solution with water.

Robinic Acid. Said to be identical with Asparagin.

Roccellic Acid. Insoluble even in boiling water. Soluble in 1.81 pts. of alcohol of 0.819 sp. gr. Very readily soluble in ether. Insoluble in dilute acids. Soluble in aqueous solutions of the alkaline carbonates. Insoluble in lime or baryta-water.

(*Roccellin.*)
$C_{24} H_{22} O_6 = C_{24} H_{21} O_5, H O$

Roccellate of Ammonia. Soluble in water. Insoluble in aqueous solutions of the caustic alkalies.

Roccellate of Baryta.

Roccellate of Lead.

I.) *basic.*
$C_{24} H_{21} Pb O_6 ; Pb O$

Roccellate of Lime.

Roccellate of Potash. Soluble in water. Insoluble in aqueous solutions of the caustic alkalies.

Roccellinin. Soluble in boiling, but scarcely at all soluble in cold alcohol. Scarcely at all soluble in cold ether. Easily soluble in ammonia-water, and in aqueous solutions of the caustic alkalies. (Stenhouse.)

$C_{36} H_{16} O_{14}$

Roccillin. *Vid.* Roccellic Acid.

Rochelle Salt. *Vid.* Tartrate of Potash & of Soda.

Rocou. *Vid.* Annotto.

Rosacic Acid (of Prout). Was impure Uric Acid.

RoseoCobalt. The salts of roseocobalt are, for the most part, nearly insoluble in cold water; but soluble, without decomposition, in slightly acidulated warm water; this solution is easily decomposed by boiling. (Gibbs & Genth, *Smithson. Contrib.*, vol. 9.)

$5 N H_3 . Co_2 O_3$

Rosito (of Batilliat). (Rose-red coloring matter in sediment of new wine.) Soluble in water, and without decomposition, in sulphuric acid of 66°. Soluble in alcohol. Insoluble in ether. (Batilliat, *Traité sur les Vins de la France.*)

Rosolic Acid. Very sparingly soluble in cold, and still less soluble in boiling water. Water precipitates it from the alcoholic solution. Readily soluble in alcohol, and ether. Soluble in concentrated sulphuric, chlorhydric, and acetic acids. Soluble, with combination, in aqueous solutions of the caustic alkalies.

$C_{46} H_{22} O_8 = C_{46} H_{21} O_7, H O$

Rosolate of Lime. Soluble in water, and alcohol. (Runge.)

Rottlerin. Insoluble in water. Sparingly soluble in cold, more soluble in boiling alcohol. Easily soluble in ether. Soluble in aqueous solutions of the caustic and carbonated alkalies. Soluble in cold concentrated sulphuric acid. (Anderson.)

$C_{22} H_{10} O_6$

Ruberythric Acid. Sparingly soluble in cold water. Very easily soluble in boiling water, alcohol, and ether. Also soluble in alkaline solutions.

$C_{32} H_{18} O_{16} = \left.\begin{matrix} C_{20} H_4 O_2{}'' \\ H . C_{12} H_{11} O_{10} \end{matrix}\right\} O_4 + 2 Aq$

Rubic Acid. Insoluble, or very sparingly soluble in water. Insoluble in dilute chlorhydric acid.

(*Rufo Catechucic Acid. Rubinic Acid.*)
$C_{18} H_6 O_{10} = C_{18} H_5 O_9, H O$

Rubate of Potash. Readily soluble in water. Insoluble in alcohol.

Rubate of Silver.
$C_{18} H_5 Ag O_{10}$

The other metallic rubates are sparingly soluble precipitates. (Svanberg.)

Rubiacic Acid. Very sparingly soluble in boiling water, and alcohol. Soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water. Also soluble, with partial decomposition, in boiling concentrated nitric acid.

$C_{31} H_6 O_{17}$(?)

Rubiacate of Potash. Soluble in water, especially if this be hot. (Schunck, *Rep. Br. Assoc.*, 1847, p. 124.)

Rubiacin. Is thought to be identical with Alizarin. Sparingly soluble in boiling water. Soluble in warm alcohol, and in boiling acetic acid, without change. Soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water. Soluble in warm dilute nitric acid, without decomposition, but it is decomposed by boiling concentrated nitric acid. Soluble in aqueous solutions of the caustic and carbonated alkalies. (Schunck, *Rep. Br. Assoc.*, 1847, p. 123.)

"$C_{31} H_9 O_{10}$"
"$C_{28} H_{17} O_{13}$", or $C_{20} H_{10} O_{10}$ (Gerhardt).

Rubiadin.

Rubiadinic Acid. *Vid.* Imasatinic Acid.

Rubiafin.

Rubiagin.

Rubian. Is considered by Rochleder to be identical with ruberthyric acid; but the latter is only sparingly soluble in cold water, while rubian is readily soluble therein. Somewhat less soluble in alcohol than in water. Insoluble in ether. Acids precipitate it from the aqueous solution. (Schunck.)

"$C_{46} H_{34} O_{30}$," or
$C_{32} H_{16} O_{16} + Aq$ (Gerhardt).

Rubianin. More soluble in water, but less soluble in alcohol, than alizarin.

Rubichloric Acid.
$C_{14} H_8 O_9, H O$

Rubinic Acid. *Vid.* Rubic Acid.

RubiTannic Acid. Very hygroscopic. Soluble in water.

$C_{28} H_{16} O_{18} + 7 Aq = C_{28} H_{14} O_{16}, 2 H O + 7 Aq$

RubiTannate of Lead. Ppt.

RufiGallic Acid. Soluble in 3333 pts. of boiling water. Insoluble, or nearly so in cold water. Difficultly soluble in alcohol or ether. Soluble in concentrated sulphuric acid.

(*Para Ellagic Acid.*)
$C_{28} H_8 O_{16} = C_{28} H_6 O_{14}, 2 H O + 4 Aq$

RufiGallate of Potash. Very soluble in water.

Rufimoric Acid. Very easily soluble in alcohol; less soluble in water. Very sparingly soluble in ether. Soluble in all proportions in water which contains a little caustic ammonia. Soluble, without alteration, in concentrated sulphuric, and chlorhydric acids; also soluble in aqueous solutions of the caustic and carbonated alkalies.

$C_{14} H_7 O_8$

Rufimorate of Copper. Ppt.
$3 Cu O, 2 C_{14} H_7 O_8$

Rufimorate of Lead. Insoluble in water, alcohol, or ammonia-water. Soluble in acetic acid, and in an aqueous solution of caustic potash.

$2 Pb O, C_{14} H_7 O_8$

Rufin. Soluble in boiling water. Readily soluble in alcohol. Almost insoluble in ether. Soluble in aqueous solutions of caustic potash, and ammonia. Soluble

$C_{42} H_{20} O_{16}$

in concentrated sulphuric acid, with combination. Insoluble in chlorhydric acid. Decomposed by nitric acid.

RufinSulphuric Acid. Soluble in water, but the solution undergoes decomposition when evaporated. (Mulder.)

RufinSulphate of Lead. Insoluble in water. (Mulder.)

RufinSulphate of Lime.

I.) $C_{14} H_7 O_5, S O_3 ; Ca O, S O_3 + H O$ Decomposed by water, which retains No. II. in solution.

II.) $2 C_{14} H_7 O_5, S O_3 ; Ca O, S O_3 + H O$ Hygroscopic. Difficultly soluble in water. Insoluble in alcohol, ether, or oils. (Mulder, *J. pr. Ch.*, **18.** 357, cited in *Wittstein's Handw.*)

RufoCatechucic Acid. *Vid.* Rubic Acid.

Rumicin. *Vid.* Chrysophanic Acid.

Rutamid. *Vid.* Rutylamid.

Ruthenic Acid. $Ru O_3$

Ruthenate of Potash.

I.) *basic.* Soluble in water, at least if this contain caustic alkali.

RuthenioCyanhydric Acid. $Ru Cy, 2 H Cy$ Easily soluble in water, and spirit. Less soluble in ether. (Claus, *Beiträge*, pp. 97, 98.)

RuthenioCyanide of Potassium. $C_6 H_3 Ru K_2 + 3 Aq = 2 K Cy, Ru Cy + 3 Aq$ Effloresces in dry air. Easily soluble in water. Difficultly soluble in spirit. It crystallizes in all proportions with ferrocyanide of potassium. (Claus, *Beiträge*, pp. 97, 99.)

Ruthenium. Ru Nearly insoluble in acids, aqua-regia alone dissolving a trace of it.

Rutic Acid. *Vid.* Rutylic Acid.

Rutilin. Insoluble in water, alcohol, or glacial acetic acid. Insoluble in alkaline solutions. Soluble in concentrated sulphuric acid. (Braconnot.) Insoluble in water, alcohol, ether, or boiling potash-lye. Soluble in concentrated sulphuric acid; also, with subsequent decomposition, in nitric acid. (Mulder.)

"Rutinic Acid." *Vid.* Quercitrin.

Rutinic Acid. $C_{12} H_8 O_8 = C_{12} H_7 O_7, H O$ Insoluble in cold, soluble in boiling water. It does not separate out from the hot solutions as this becomes cold, but by evaporation it may be recrystallized. It behaves in a similar manner with alcohol. Insoluble in ether.

Rutinate of Lead. Ppt.

"Rutin." *Vid.* Quercetrin.

RutylAldehyde. *Vid.* Hydride of Rutyl.

Rutylamid. (*Rutamid. Caprinamid. Capramid.*) $N \left\{ \begin{matrix} C_{20} H_{19} O_2 \\ H_2 \end{matrix} \right.$ Insoluble in water, or ammonia-water. Easily soluble in alcohol, and ether. (Rowney.)

Rutylic Acid. (*Capric Acid.*) $C_{20} H_{20} O_4 = C_{20} H_{19} O_3, H O$ Insoluble in cold, sparingly soluble in boiling water. Readily soluble in cold alcohol, and ether. Soluble, without alteration, in warm concentrated nitric, and chlorhydric acids, from which solutions it is precipitated on the addition of water. (Rowney.) Soluble in about 1000 pts. of water at 20°. Soluble in all proportions in absolute alcohol. (Chevreul.) All caprates, excepting those of the alkalies, are but sparingly soluble in water. (Lerch.)

Rutylate of Ammonia. Soluble in water.

Rutylate of Baryta. $C_{20} H_{19} Ba O_4$ Permanent. Soluble in boiling, less soluble in cold water. Less soluble in water than the caprylate. After having become dry it is insoluble in water, since this cannot moisten it, but if wet with alcohol it again becomes soluble in water. Soluble in boiling alcohol.

100 pts. of water at 20° dissolve 0.5 pt. of it; the aqueous solution undergoes decomposition when left to itself. (Chevreul. [T.].)

Rutylate of Copper. Insoluble in water, or alcohol. Soluble in ammonia-water.

Rutylate of Ethyl. (*Capric Ether.*) $C_{20} H_{19} (C_4 H_5) O_4$ Insoluble in cold water. Easily soluble in alcohol, and ether. (Rowney.)

Rutylate of Lead. $C_{20} H_{19} Pb O_4$ Insoluble in water. Very sparingly soluble in boiling alcohol. (Rowney.)

Rutylate of Lime. $C_{20} H_{19} Ca O_4$ More soluble than the baryta-salt in water, and alcohol. (Rowney.) Soluble in boiling water, though less readily than the baryta-salt, crystallizing out on cooling. (Gottlieb.)

Rutylate of Magnesia. $C_{20} H_{19} Mg O_4$ Difficultly soluble in cold water.

Rutylate of Potash. Very easily soluble in water.

Rutylate of Silver. $C_{20} H_{19} Ag O_4$ Insoluble in cold, sparingly soluble in boiling water; more soluble in boiling alcohol. Easily soluble in ammonia-water.

Rutylate of Soda. $C_{20} H_{19} Na O_4$ Readily soluble in cold water, and alcohol.

Rutylate of Strontia. $C_{20} H_{19} Sr O_4$ 100 pts. of water at 17.7° dissolve 0.5 pt. of it. (Chevreul. [T.].)

Rutylic Aldehyde. *Vid.* Hydride of Rutyl.

S.

Sabadillic Acid (from *Veratrum Sabadilla*). Soluble in water, alcohol, and ether. (Pelletier & Caventou.)

Sabadillin (from *Veratrum Sabadilla*).

I.) *anhydrous.* $C_{20} H_{13} N O_5$ Sparingly soluble in cold, easily soluble in boiling water. Also soluble in alcohol, from which it does not crystallize on cooling. Insoluble in ether. Soluble, with combination, in dilute acids. (Courbe.) Simon doubted the existence of sabadillin, asserting that it was nothing but a mixture of resinate of soda, and resinate of veratrin; but Huebschmann supports Courbe's results, and describes it as being soluble in 143 pts. of boiling water. Ether only dissolves traces. The aqueous solution is partially precipitated on the addition of carbonate of potash, but not by ammonia-water.

II.) *hydrated.* $C_{20} H_{14} N O_6$ Easily soluble in water, and alcohol. Insoluble in ether. Soluble in acids, with combination. (Courbe.)

Saccharic Acid. (*Oxalhydric Acid. Hydr Oxalic Acid. Zuckersæure.*) $C_{12}H_{10}O_{18}=C_{12}H_8O_{14}, 2HO$ Very deliquescent. Easily soluble in water. Miscible, in all proportions, with alcohol. (Guérin-Varry.) Readily soluble in alcohol. (Heintz.) Sparingly soluble in boiling ether. Insoluble in cold, and only very sparingly soluble in boiling oil of turpentine. (Guérin-Varry.)

The bibasic saccharates are sparingly soluble in water; the monobasic salts, however, are easily soluble.

Saccharate of Ammonia.

I.) *normal.* Easily soluble in water. (Varry.) More soluble than the acid salt in water. (Heintz.)

II.) *acid.* $C_{12}H_9(NH_4)O_{16}$ Permanent. Soluble in 82 pts. of water at 15°, and in 4 pts. of boiling water. Insoluble in cold, soluble in hot alcohol. (Varry.) Sparingly soluble in water. Somewhat soluble in an aqueous solution of bisaccharate of potash.

Saccharate of AmmoniumChloroPlatin(ous)ammonium. (*Gros's Saccharate.*) Somewhat soluble in water. (Gros, *Ann. der Pharm.*, 1838, **27**. 256.)

Saccharate of Baryta.

I.) *normal.* $C_{12}H_8Ba_2O_{16}$ When precipitated from cold solutions it is moderately soluble in water (Varry, Heintz); but when precipitated from hot solutions it is crystalline, and very sparingly soluble in water. (Heintz.) Soluble in saccharic acid.

II.) *acid.* Soluble in water.

Saccharate of Bismuth. $C_{12}H_4Bi_2O_{16}+4Aq$ Insoluble in water. Sparingly soluble in acids. (Heintz.)

Saccharate of Cadmium. $C_{12}H_8Cd_2O_{16}$ Nearly insoluble in cold, somewhat more soluble in boiling water. (Heintz.)

Saccharate *of sesquioxide* **of Chromium.** Soluble in water.

Saccharate of Copper. Slightly soluble in water. (Heintz.)

Saccharate *of protoxide* **of Iron.** Soluble in water.

Saccharate *of sesquioxide* **of Iron.** Soluble in water.

Saccharate of Lead.

I.) *normal?* Insoluble in cold, sparingly soluble in boiling water. Readily soluble in saccharic and other acids; also soluble in ammonia-water. (Erdmann.)

II.) *acid?* Soluble in water. (Erdmann.)

III.) *basic.* Insoluble in water. (Erdmann.)

Saccharate of Lime.

I.) *normal.* $C_{12}H_8Ca_2O_{16}+2Aq$ When precipitated from cold solutions it is moderately soluble in water (Varry, Heintz); but when precipitated from hot solutions it is crystalline and nearly insoluble in boiling water. (Heintz.) Soluble in saccharic and chlorhydric acids.

II.) *acid.*

Saccharate of Magnesia. $C_{12}H_8Mg_2O_{16}+6Aq$ Very sparingly soluble in cold, somewhat more readily soluble in boiling water. (Heintz.)

Saccharate *of protoxide* **of Mercury**(Hg O). Nearly insoluble in water. (Varry.)

Saccharate of Potash.

I.) *normal.* $C_{12}H_8K_2O_{16}$ Deliquesces in very damp air. Soluble in water.

II.) *acid.* $C_{12}H_9KO_{16}$ Soluble in 88 @ 90 pts. of water at 6° @ 8°. (Heintz.) Sparingly soluble in cold, tolerably soluble in warm, and easily soluble in hot water. (Heintz.)

Saccharate of Silver. $C_{12}H_8Ag_2O_{16}$ Sparingly soluble in cold, more readily soluble in hot water. Readily soluble in ammonia-water. On boiling the solutions they are decomposed.

Saccharate of Soda.

I.) *normal.* Deliquescent. Soluble in water.

II.) *acid.* Soluble in water.

Saccharate of Strontia.

I.) *normal.* Ppt.

II.) *acid.*

Saccharate of Zinc.

I.) *normal.* $C_{12}H_8Zn_2O_{12}+Aq$ Insoluble in cold, sparingly soluble in boiling water; more soluble in saccharic acid. (Varry; Thaulow.)

Safranin(from *Crocus Sativa*). (*Polycroite. Crocic Acid.*) $C_{20}H_{13}O_{11}$ Very sparingly soluble in water. Readily soluble in alcohol. Almost insoluble in ether, and in the fatty and essential oils. Easily soluble in aqueous solutions of the caustic alkalies. (N. E. Henry.) Soluble in water, a trace of free alkali in the latter increasing the solubility to a high degree. Easily soluble in alcohol. Very difficultly soluble in ether. (Quadrat.)

Sagepenum. See under **Resins.**

Sal-ammoniac. *Vid.* Chloride of Ammonium.

Sal Alembroth. *Vid.* Chloride of Ammonium & of Mercury(Hg Cl).

Salhydramid. *Vid.* Hydride of AzoSalicyl.

Salicin. $C_{26}H_{18}O_{14}=\left.\begin{matrix}C_{14}H_7O_2\\C_{12}H_{11}O_{10}\end{matrix}\right\}O_2$ Permanent. Soluble in 17.85 pts. of water at 19.5°, and more freely, perhaps in all proportions, in boiling water. (Pelouze & Gay-Lussac.) Soluble in 14 pts. of water at 17° (Braconnot); in 30.31 pts. at 11.5° (Piria); in 28.57 pts. at the ordinary temperature (Bouchardat); in 6 pts. of water at 18.75° (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76); in 5.6 pts. of cold, and in much less boiling water; in 22 pts. of cold, and 0.5 pt. of hot water.

No more soluble in alcohol than in water. (Braconnot.) Soluble in 30 pts. of cold, and 3 pts. of hot alcohol. Insoluble in ether, oil of turpentine, or the fatty oils.

Soluble in cold, and more abundantly in hot creosote (Reichenbach); and in warm hydrate of anisyl. Soluble in acetic acid, and may be obtained again unchanged by evaporating the solution to dryness. (Braconnot; Hopff.) More easily soluble in aqueous solutions of the alkalies than in water. Does not combine with acids. Soluble, with decomposition, in concentrated sulphuric acid. Decomposed by dilute sulphuric and chlorhydric acids. Cold concentrated nitric acid dissolves salicin more abundantly than water, and does not decompose it at first. (Braconnot.)

Salicin with Oxide of Lead. $C_{26}H_{14}Pb_4O_{14}$ Insoluble in water. Soluble in acetic acid, and in an aqueous solution of caustic potash.

Salicon. *Vid.* Phenic Acid.

Salicylamic Acid. Sparingly soluble in cold, more abundantly soluble in boiling water. (Procter.) Scarcely at all soluble in cold, much more soluble in boiling water. Still more soluble in alcohol, and ether. (Cahours, *Ann. Ch. et Phys.*, (3.) **10.** 350.) Abundantly soluble in alcohol, and ether, especially when these are hot; also soluble in aqueous solutions of caustic potash and ammonia. (Procter.) Soluble in warm aqueous solutions of caustic ammonia and of the alkaline carbonates, separating out again unchanged when these solutions are evaporated. (Limpricht.)

(Isomeric with Anthranilic and Benzamic Acids.)

$C_{14} H_7 N O_4 = N \left\{ \begin{matrix} C_{14} H_4 O_2'' \\ H_2 \end{matrix} \right. . O, H O$

Salicylamate of Baryta. Easily soluble in water.

Salicylamate of Copper. Ppt.

$C_{14} H_6 Cu N O_4$

Salicylamate of Ethyl. *Vid.* EthylSalicylamic Acid.

Salicylamate of Lime. Very easily soluble in water.

$C_{14} H_6 Ca N O_4$

Salicylamate of Magnesia. Easily soluble in water.

Salicylamate of Potash. Soluble in water.

Salicylamate of Silver. Ppt.

$C_{14} H_6 Ag N O_4$

Salicylamate of Soda. Soluble in water.

Salicylamate of Strontia. Soluble in water. (Limpricht, *Ann. Ch. u. Pharm.*, **98.** 256.)

$C_{14} H_6 Sr N O_4$

Salicylamid. Insoluble in water. Scarcely at all soluble in boiling alcohol, or ether. Soluble in an alcoholic, but insoluble in an aqueous solution of caustic ammonia. (Limpricht.)

$C_{14} H_5 N O_2 = N \left\{ \begin{matrix} C_{14} H_4 O_2'' \\ H \end{matrix} \right.$

SalicylAnilid. *Vid.* PhenylSalicoylamid.

Salicylic Acid(Anhydrous).

I.) Insoluble in boiling water, or ether. Extremely sparingly soluble in boiling alcohol. (Gerhardt & Socoloff, *Ann. Ch. et Phys.*, (3.) **37.** 323.)

(Salicylid.)

$C_{14} H_4 O_4 = \left. C_{14} H_4 O_2'' \right\} O_2$

II.) *meta (or mono atomic) Salicylic Acid.* Insoluble in cold, acidified by boiling water. Soluble in boiling, less soluble in cold alcohol. Soluble in boiling ether. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **37.** 323.)

(Salicylic Anhydride. Salicylic salicylate. Salicylate of Salicyl.)

$C_{14} H_5 O_5 = \left. \begin{matrix} C_{14} H_4 O_2'' \\ H \end{matrix} \right\} O_3$

Salicylic Acid. Permanent. Sparingly soluble in cold; abundantly soluble in boiling water. (Strecker.) Soluble in 1087 pts. of water at 0°. (Kolbe, *Lehrb.*, **2.** 247.) Very sparingly soluble in water at the ordinary temperature; much more soluble in boiling water. Easily soluble in alcohol, especially when this is warm; being much more soluble in alcohol than in water. Tolerably readily soluble in wood-spirit, especially when this is warm. Readily soluble in cold, and still more soluble in warm ether. Scarcely at all soluble in cold, but soluble in about 5 pts. of boiling oil of turpentine. (Cahours, *Ann. Ch. et Phys.*, (3.) **10.** 338; & (3.) **13.** 90.)

(Spiroylic Acid. HyperSpiroylic Acid. Isomeric with Ampelic, and OxyBenzoic Acids.)

$C_{14} H_6 O_6 = C_{14} H_4 O_4, 2 H O$

Salicylate of Acetyl.

$C_{14} H_5 (C_4 H_3 O_2) O_6$

Salicylate of Ammonia.

I.) *acid.* Very soluble in water. (Cahours, *loc. cit.*)

$C_{14} H_5 (N H_4) O_6$

Salicylate of Amyl.

I.) *acid.* Insoluble in water.

(Hydrate of AmylSalicyl.)

$C_{14} H_5 (C_{10} H_{11}) O_6$

Salicylate of Amyl & of Benzoyl.

(Benzoate of AmylSalicyl.)

$C_{14} H_4 (C_{10} H_{11} . C_{14} H_5 O_2) O_6$

Salicylate of Amyl & of Ethyl.

Salicylate of Amyl & of Methyl.

$C_{14} H_4 (C_{10} H_{11}) (C_2 H_3) O_6$

Salicylate of Baryta.

I.) *normal.* Much less soluble in water than the acid salt. (Piria.)

$C_{14} H_4 Ba_2 O_6 + 4 Aq$

II.) *acid.* Easily soluble in water. (Ettling.) Very readily soluble in water. (Cahours, *Ann. Ch. et Phys.*, (3.) **13.** p. 94.)

$C_{14} H_5 Ba O_6 + Aq$

Salicylate of Baryta & of Copper. Insoluble in water. (Piria.)

$C_{14} H_4 Ba Cu O_6 + 4 Aq$

Salicylate of Benzoyl. Soluble in ether.

$C_{14} H_5 (C_{14} H_5 O_2) O_6$

Salicylate of Benzoyl & of Ethyl. Easily soluble in alcohol, and ether.

(Benzoate of EthylSalicyl.)

$C_{14} H_4 (C_4 H_5 . C_{14} H_5 O_2) O_6$

Salicylate of Benzoyl & of Methyl. Insoluble in water. Easily soluble in alcohol, and ether. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **45.** 93.)

(Benzoate of MethylSalicyl.)

$C_{14} H_4 (C_2 H_3 . C_{14} H_5 O_2) O_6$

Salicylate of Copper.

I.) *normal.* Almost insoluble in water, alcohol, or ether. (Piria.)

$C_{14} H_4 Cu_2 O_6 + 2 Aq$

II.) *acid.* Readily soluble in large quantities of water, alcohol, and ether; but it is decomposed by these liquids when added in small proportions, especially if they are warm. (Piria, *Ann. Ch. u. Pharm.*, **93.** 264.)

$C_{14} H_5 Cu O_6 + 4 Aq$

Salicylate of Copper & of Potash. Very readily soluble in water. Insoluble in alcohol or ether. (Piria.)

$C_{14} H_4 Cu K O_6 + 4 Aq$

Salicylate of Ethyl.

I.) *normal.*

II.) *acid*, or *mono.* *Vid.* EthylSalicylic Acid.

$C_{14} H_5 (C_4 H_5) O_6$

Salicylate of Ethyl & of Succinyl. Insoluble in water. Very soluble in boiling alcohol. Sparingly soluble in ether. (Gerhardt.)

(Succinate af EthylSalicyl.)

$C_{44} H_{22} O_{16} = C_{14} H_4 (C_4 H_5)_2 O_6$;

$C_{14} H_4 (C_8 H_4 O_4'') O_6$

Salicylate of Lead.

I.) *normal.* Very sparingly soluble in water. (Piria.)

$C_{14} H_4 Pb_2 O_6$

II.) *acid.* Very sparingly soluble, or insoluble in cold, soluble, with decomposition, in boiling water. (Piria.) Sparingly soluble in cold, easily soluble in boiling water. (Cahours, *Ann. Ch. et Phys.*, (3.) **13.** pp. 91, 98.)

$C_{14} H_5 Pb O_6 + Aq$

III.) *penta.* Insoluble, or very sparingly soluble in water. (Piria.)

$C_{14} H_4 Pb_2 O_6 ; 3 Pb O$

Salicylate of Lime.
I.) *normal.* Nearly insoluble in water. (Piria.)
$C_{14} H_4 Ca_2 O_6 + 2 Aq$
II.) *acid.* Tolerably easily soluble in water.
$C_{14} H_5 Ca O_6 + 2 Aq$ (Cahours, *loc. cit.*; Ettling.)

Salicylate of Magnesia. Easily soluble in water at the ordinary temperature, and still more readily soluble in boiling water. (Cahours, *Ann. Ch. et Phys.*, (3.) **13.** 97.)

Salicylate of Methyl.
(*MethylSalicylate of Methyl.*)
I.) *normal.*
$C_{14} H_4 (C_2 H_3)_2 O_6$
II.) *acid, or mono.* *Vid.* MethylSalicylic Acid.
$C_{14} H_5 (C_2 H_3) O_6$

Salicylate of Methyl*bromé*, &c. *Vid.* Bromo(&c.)Salicylate of Methyl.

Salicylate of MethylCumyl. *Vid.* Cuminate of MethylSalicyl.

Salicylate of Methyl & of Succinyl.
(*Succinate of MethylSalicyl.*)
$C_{40} H_{18} O_{16} = O_{14} H_4 (C_2 H_3)_2 O_6;$
$C_{14} H_4 (C_8 H_4 O_4'') O_6$
Sparingly soluble in cold, somewhat soluble in boiling alcohol. Sparingly soluble in ether. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **45.** 96.)

Salicylate of Potash.
I.) *acid.* Soluble in water, and in boiling con-
$C_{14} H_5 K O_6 + Aq$
centrated alcohol. Readily soluble in alcohol, and ether. (Cahours, *loc. cit.*)

Salicylate of Salicyl. *Vid.* Salicylic Acid(Anhydrous, No. II.).

Salicylate of Silver.
I.) *acid.* Almost insoluble in cold, sparingly
$C_{14} H_5 Ag O_6$
soluble in warm water. (Ettling; Cahours, *loc. cit.*)

Salicylate of Soda. Soluble in water. (Cahours, *loc. cit.*)

Salicylate of Strontia. Soluble in water. (Cahours, *loc. cit.*)

Salicylate of Zinc. Soluble in water. (Cahours, *loc. cit.*)

SalicylBenzamic Acid.
(*BenzoylSalicylamic Acid. BenzoylSalicylamide*(of Gerhardt).)
$C_{28} H_{11} N O_6 = N \left\{ \begin{matrix} C_{14} H_4 O_2'' \\ C_{14} H_5 O_2 \\ H \end{matrix} \right. . O, H O$
When amorphous it is easily soluble in alcohol; but the matter thus dissolved soon passes into a crystalline modification, which is deposited in great part from the alcohol. The crystalline modification is very sparingly soluble in alcohol, and almost insoluble in ether. It is not sensibly soluble in boiling water; but dissolves in warm ammonia-water and in other alkaline liquors. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 139.) Soluble, with decomposition, in aqueous solutions of potash, soda, strontia, or warm carbonate of soda. (Limpricht.)

SalicylBenzamate of Silver. When in
$C_{28} H_{10} Ag N O_6$
the viscous state it is easily soluble in alcohol.

SalicylBenzoyl. *Vid.* BenzoSalicyl.

SalicylBenzoylamid.
(*BenzoylSalicylimid.*)
$C_{28} H_9 N O_4 = N \left\{ \begin{matrix} C_{14} H_4 O_2'' \\ C_{14} H_5 O_2 \end{matrix} \right.$
Soluble in about 1000 pts. of boiling spirit. (Limpricht.)

SalicylCumylamic Acid.
(*CumylSalicylamid. SalicylCumylamid.*)
$C_{34} H_{17} N O_6 = N \left\{ \begin{matrix} C_{14} H_4 O_2'' \\ C_{20} H_{11} O_2 \\ H \end{matrix} \right. . O, H O$
Almost entirely insoluble in water. Very difficultly soluble in ammonia-water. When in the viscous condition it is soluble in cold alcohol, but soon separates out again in a crystalline state. It is slightly more soluble than salicylbenzamic acid in alcohol. Very sparingly soluble in ether. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 141.)

Salicylid. *Vid.* Salicylic Acid(Anhydrous, No. I.)

"**Salicylide of** *X*." *Vid.* Salicylite of *X*.

Salicylide of Acetyl. *Vid.* AcetoSalicyl.

Salicylide of Benzoyl. *Vid.* BenzoSalicyl.

Salicylide of Toluyl. *Vid.* ToluoSalicyl.

Salicylimid(of Gerhardt). *Vid.* Hydride of AzoSalicyl.

Salicylimid(of Limpricht). *Vid.* Salicylamid.

Salicylous Acid.
(*Hydride of Salicyl. Spiroylous Acid. Spirous Acid. Ulmaric Acid. Salicoylic Acid. Essence de reine des prés. Isomeric with Benzoic Acid.*)
$C_{14} H_6 O_4 = C_{14} H_5 O_3, H O$
Abundantly soluble in water. Soluble in all proportions in alcohol, and ether. Readily soluble, with combination, in aqueous solutions of the caustic and carbonated alkalies. Decomposed by concentrated sulphuric acid. The alkaline salts of salicylous acid are tolerably soluble in water; the other salts are insoluble.

Salicylite of Ammonia.
(*Salicylammonium.*)
I.) *normal.* Insoluble in water. Sparingly sol-
$C_{14} H_5 (N H_4) O_4$
uble in cold, abundantly soluble in hot alcohol.
II.) *acid.* More soluble in alcohol than in water. (Berzelius.)

Salicylite of Baryta. Very sparingly
$C_{14} H_5 Ba O_4 + 2 Aq$
soluble in cold water.

Salicylite *of dinoxide* **of Copper.** Ppt.

Salicylite *of protoxide* **of Copper.** Diffi-
$C_{14} H_5 Cu O_4$
cultly soluble in water or alcohol.

Salicylite *of protoxide* **of Iron.** Ppt.

Salicylite *of sesquioxide* **of Iron.** Soluble in water.

Salicylite of Lead.
I.) *basic.* Insoluble in water. (Lœwig &
$C_{14} H_5 Pb O_4; Pb O$
Weidmann.)

Salicylite of Lime. Sparingly soluble in water.

Salicylite of Magnesia. Nearly insoluble in water. (Lœwig.)

Salicylite *of protoxide* **of Mercury.** Ppt.

Salicylite of Potash.
I.) *normal.* Permanent in dry air. Sparingly
$C_{14} H_5 K O_4$
soluble in water. Readily soluble in hot, less soluble in cold absolute alcohol. (Piria.) Soluble in less than 4 vols. of hot alcohol of 50%. (Ettling.)
II.) *acid.* Decomposed by water. Soluble in
$C_{14} H_5 K O_4, C_{14} H_6 O_4$
hot, less soluble in cold alcohol. (Ettling.)

Salicylite of Silver. Ppt. Decomposed when heated with water. (Lœwig & Weidmann.)

Salicylite of Soda.
I.) *acid.* Soluble in hot, less soluble in cold
$C_{14} H_5 Na O_4, C_{14} H_6 O_4 + Aq$
alcohol. (Ettling.)

Salicylite of Strontia. Sparingly soluble in water.

Salicylite of Zinc.

SalicylosAnilid. *Vid.* PhenylSalicoylamid.

Salicyluric Acid. Readily soluble in boiling, less soluble in cold water. Readily soluble in alcohol. Tolerably soluble in ether. Soluble in warm, fuming chlorhydric acid, and separates out unchanged when the solution is cooled; but when the chlorhydric solution is boiled during two or three hours it is decomposed. (Bertagnini.)

$C_{18}H_9NO_8$

Salicylurate of Baryta. Sparingly soluble in cold water.

Salicylurate of Lime.

I.) Sparingly soluble in cold water. Insoluble in alcohol.

II.) Insoluble in boiling water.

Saligenin. Soluble in 15 pts. of water at 22°, and in almost all proportions in boiling water. Very soluble in alcohol, and ether. Ether removes it from the aqueous solution. Soluble in cold ammonia-water, without sensible alteration at first; but the solution subsequently undergoes decomposition. Decomposed by acids. (Piria, *Ann. Ch. et Phys.*, (3.) **14.** 261.)

$C_{14}H_8O_4$

Saliretin. Insoluble in water, or ammonia-water. Soluble in alcohol, ether, and concentrated acetic acid, from which solutions it is precipitated on the addition of water. Also soluble in aqueous solutions of caustic potash and soda. (Piria.)

(*Salicetin.*)
$C_{14}H_6O_2$

Salithol. *Vid.* Phenate of Ethyl.

Saltpetre. *Vid.* Nitrate of Potash.

Salt of Tartar. *Vid.* Carbonate of Potash.

Salylic Acid. Very easily soluble in boiling water, and is also much more abundantly soluble in cold water than benzoic acid. Soluble in 237 pts. of water at 0°. Easily soluble in alcohol, and ether, especially in the latter. Its salts are all soluble in water. (Kolbe & Lautemann, *Ann. Ch. u. Pharm.*, **115.** 187. [K.].)

(*Isomeric with Benzoic Acid.*)
$C_{14}H_6O_4 = C_{14}H_5O_3, HO$

Salylate of Baryta. More soluble in water than the benzoate. (K. & L.)

$C_{14}H_5BaO_4 + 2Aq$

Salylate of Lime. Soluble in water.

$C_{14}H_5CaO_4 + 3Aq$

Salylate of Silver. Soluble in hot, less soluble in cold water. (Griess.)

$C_{14}H_5AgO_4$

Salylate of Zinc. Soluble in water, but the solution is decomposed on boiling.

Sandarach. See under **Resins.**

Sanguinarin. Insoluble in water. Readily soluble in alcohol, and in acids, with combination, forming salts which are for the most part readily soluble in water. (Dana.) Insoluble in water. Soluble in alcohol, and ether. Most of its salts are soluble in water. (Probst, *Ann. der Pharm.*, **29.** 120.) Soluble in ether. (Schiel, *Am. J. Sci.*, (2.) **20.** 220.) Soluble in ether and in the fixed and volatile oils. Partially soluble in aqueous solutions of the caustic alkalies, and in acetic acid. (Parrish's *Pharm.*, pp. 193, 398.)

(*Chelerythrin.*)
$C_{36}H_{17}NO_8 = N\left\}C_{36}H_{17}O_8'''\right.$

Santalic Acid. Insoluble in water. Readily soluble in alcohol, and ether. Easily soluble in aqueous solutions of caustic ammonia, and potash.

(*Santalin.*)
$C_{30}H_{14}O_{10} = C_{30}H_{13}O_9, HO$

Santalate of Baryta. Ppt.

$C_{30}H_{13}BaO_{10}$

Santalate of Lead.

I.) *basic.* Ppt.

$C_{30}H_{13}PbO_{10}, PbO, HO$

Santonic Acid. Permanent. Almost insoluble in cold, somewhat more soluble in boiling water. Soluble in 5000 pts. of water at 17.5°, and in 250 pts. at 100°.

(*Santonin.*)
$C_{30}H_{18}O_6 = C_{30}H_{17}O_5, HO$

Readily soluble in boiling alcohol. Soluble in 43 pts. of alcohol at 22.5°; in 12 pts. at 50°, and in 2.7 pts. at 80°. Less soluble in ether, being soluble in 75 pts. of ether at 17.5°, and in 42 pts. at 40°. (Trommsdorff.) 100 pts. of chloroform dissolve 23 pts. of pure santonin, and 33.3 pts. of that which has become yellow from exposure to sunlight. (Schlimpert, *Kopp & Will's J. B., für* 1859, p. 405.) Soluble, without decomposition, in cold concentrated sulphuric acid, from which solution it is precipitated on the addition of water. Also soluble in strong nitric acid; but is decomposed by weak nitric acid. Soluble in aqueous solutions of the fixed caustic alkalies. The salts of santonin are decomposed when boiled with water.

Santonate of Baryta.

$C_{30}H_{17}BaO_6 + 3Aq$

Santonate of Lead.

$C_{30}H_{17}PbO_6 + Aq$

Santonate of Lime. Soluble in water, and in weak alcohol.

$C_{30}H_{17}CaO_6 + 2Aq$

Santonate of Potash. Soluble in water.

Santonate of Soda. Abundantly soluble in water. Soluble in strong alcohol.

$C_{30}H_{17}NaO_6 + 8Aq$

Santonate of Zinc.

Santonin. *Vid.* Santonic Acid.

Sapogenin. *Vid.* Quinovatic Acid.

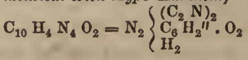
Saponic Acid. *Vid.* Quinovatic Acid.

Saponin. Sparingly soluble in cold, abundantly soluble in hot water. Soluble in absolute alcohol, but more readily in dilute spirit. More soluble in hot than in cold alcohol. Insoluble in ether. (Bolley, *Ann. Ch. u. Pharm.*, **90.** 212.) Easily soluble in water. More difficultly soluble in alcohol in proportion as this is stronger. 500 pts. of boiling absolute alcohol dissolve only 1 pt. of it, and this is almost completely deposited as the solution cools. Insoluble in ether. (Wittstein's *Handw.*) Decomposed by chlorhydric and nitric acids. Soluble in concentrated sulphuric acid, apparently with decomposition.

(*Senegin. Seneguin. Polygallic Acid. Githagin. Struthün. Polygalin.*)
$C_{36}H_{28}O_{20}$ (or O_{24})

Sarcin. Soluble in 300 pts. of water at 15°, and in 78 pts. of boiling water. Soluble in 900 pts. of boiling alcohol. Much more readily soluble in dilute chlorhydric acid, and in aqueous solutions of caustic ammonia, potash, or even baryta, than in water; less readily soluble in dilute nitric or sulphuric acids, but soluble in these acids when concentrated. Most of the salts of sarcin are decomposed by water. (Strecker, *J. Ch. Soc.*, **10.** 122.)

(*Sarkin. Isomeric, possibly identical with Hypo-Xanthin.*)



$$C_{10}H_4N_4O_2 = N_2\left\{\begin{matrix}(C_2N)_2\\ C_6H_2''.O_2\\ H_2\end{matrix}\right.$$

Sarcin with Baryta.
$C_{10} H_2 Ba_2 N_4 O_2 + 4 Aq$

Sarcin with Copper. Ppt. Insoluble in water.

Sarcin with *protoxide* of Mercury. Ppt. Insoluble in water.

Sarcin with Silver. Insoluble in water, or ammonia-water, even when these are boiling.
$C_{10} H_2 Ag_2 N_4 O_2 + Aq$ & $2 Aq$

Sarcin with Zinc. Ppt. Insoluble in water.

Sarcocollin(from the sap of *Pœnea mucronata*). Soluble in 40 pts. of cold, and in 25 pts. of boiling water. Soluble in almost all proportions in alcohol. Insoluble in ether. The saturated aqueous solution deposits a substance which is no longer soluble in water.

SarcoLactic Acid. *Vid.* Lactic Acid(modification α, from flesh).

Sarcosin. Very soluble in water. Very sparingly soluble in alcohol. Insoluble in ether. Soluble in an aqueous solution of protochloride of mercury. (Liebig.)
(Isomeric with Alanin, Urethan, and Lactamid.)
$C_6 H_7 N O_4 = N \left\{ \begin{matrix} C_2 H O_2 \\ C_4 H_5 \\ H \end{matrix} \right. . O_2$

Sassafras-Camphor.
$C_{20} H_{10} O_4$

Sassaparillin. *Vid.* Smilacin.

Scammonic Acid. Hygroscopic. Soluble in water.

Scammonate of Lead. Insoluble in aqueous solutions of caustic ammonia, or acetate of ammonia. Soluble in dilute acetic acid. (Keller, *Ann. Ch. u. Pharm.*, **104.** 63.)
$C_{76} H_{64} O_{43}, 4 Pb O$

Scammonolic Acid. Insoluble in water. Soluble in alcohol, and ether.
$C_{36} H_{35} O_7 = C_{36} H_{32} O_4, 2 H O + Aq$

Scammonolate of Baryta.
I.) *normal.*
$C_{36} H_{32} Ba_2 O_6$
II.) *acid.*
$C_{36} H_{33} Ba O_6 + Aq$
Scarcely at all soluble in water. Easily soluble in boiling alcohol. (Keller, *Ann. Ch. u. Pharm.*, **104.** 63.)

Scammony Resin. See under Resins.

Scheererite. Insoluble in water. Sparingly soluble in alcohol. Readily soluble in ether.
$C_{40} H_{20}''$

Scillitin(from *Scilla maritima*). Hygroscopic. Easily soluble in water. (Bley.) Permanent. Sparingly soluble in water. Very soluble in alcohol. Soluble in concentrated sulphuric and nitric acids. (Labourdais, *Ann. Ch. et Phys.*, (3.) **24.** 63.) Hygroscopic. Sparingly soluble in water. Soluble in alcohol. Insoluble in ether. (Tilloy.) Insoluble in water or oils. Soluble in 120 pts. of alcohol. Soluble in acids, with combination. (Landerer.)

Scleretinite. Insoluble in water, alcohol, ether, or in aqueous solutions of the caustic or carbonated alkalies, or in acids, excepting strong nitric acid, by which it is somewhat attacked. (J. W. Mallet.)
(Pyroretin.)
$C_{20} H_{14} O_2$

Scoparin. Sparingly soluble in cold water; readily soluble in boiling water, and alcohol. After having been boiled with a quantity of alcohol insufficient to dissolve it the undissolved portion becomes very sparingly soluble in water or alcohol, but regains its solubility when dissolved in ammonia-water, and is precipitated therefrom by acetic acid. Easily soluble in aqueous solutions of the caustic alkalies, and alkaline earths.
$C_{42} H_{22} O_{20}$

Scordein(from *Teucrium Scordium*).

Scrophularin. Soluble in water. (Parrish's *Pharm.*, p. 423.)

Scutellarin(from *Scutellaria lateriflora*).

Scyllite. Permanent. Less soluble than inosite in water. Insoluble in alcohol. Insoluble in cold nitric acid of 1.3 sp. gr. Slowly soluble, without alteration, in the same acid when boiling. Alcohol precipitates it from the aqueous and nitric acid solution. Unacted upon by cold, but is decomposed by hot concentrated sulphuric acid.

Sebacic Acid. Very sparingly soluble in cold, readily soluble in warm water. Readily soluble in alcohol, ether, and the fatty and essential oils. (Berzelius.) Insoluble in cold, but soluble, with partial decomposition, in hot nitric acid of 1.3 @ 1.4 sp. gr. When this solution is diluted with water, the unaltered sebacic acid is precipitated. (Schlieper, *Am. J. Sci.*, (2.) **7.** 420.) It is also soluble, without decomposition, in concentrated sulphuric acid, and, as a rule, is not easily decomposed by the action of acids or alkalies.
(Pyr Oleic Acid. Fettsæure. Sebacylic Acid.)
$C_{20} H_{18} O_8 = C_{20} H_{16} O_6, 2 H O$

The alkaline sebates are readily soluble in water; those of the alkaline earths are difficultly soluble, and those of the heavy metals insoluble.

Sebate of Ammonia.
I.) *normal.* Readily soluble in water.
$C_{20} H_{16} (N H_4)_2 O_8$
II.) *acid.* Soluble in boiling, less soluble in cold water. Sparingly soluble in alcohol. (Berzelius.)
$C_{20} H_{17} (N H_4) O_8$

Sebate of Baryta. Somewhat soluble in water. (Bouis.)

Sebate *of protoxide* of Copper. Ppt.
$C_{20} H_{16} Cu_2 O_8$

Sebate of Ethyl. Insoluble in cold water. Very easily soluble in alcohol. (Rowney, *J. Ch. Soc.*, **4.** 334.) Also soluble in ether.
$C_{20} H_{16} (C_4 H_5)_2 O_8$

Sebate *of sesquioxide* of Iron. Insoluble in water. Partially soluble in ammonia-water, with separation of a basic salt.

Sebate of Lead.
I.) $C_{20} H_{16} Pb_2 O_8$ Insoluble in water. (Berzelius.)
II.) *basic.*

Sebate of Lime. Very sparingly soluble in water. (Bouis.)
$C_{20} H_{16} Ca_2 O_8$

Sebate *of protoxide* of Mercury.

Sebate of Methyl. Soluble in alcohol.
$C_{20} H_{16} (C_2 H_3)_2 O_8$

Sebate of Potash. Permanent. Very readily soluble in water. Sparingly soluble in absolute alcohol. (Redtenbacher.)
$C_{20} H_{16} K_2 O_8$

Sebate of Silver. Very sparingly soluble in boiling water. Difficultly soluble in alcohol, and ether.
$C_{20} H_{16} Ag_2 O_8$

SEBATE OF SODA. Less soluble in water than the potash salt.

Soluble in water. Insoluble in hot absolute alcohol. (Schlieper, *Am. J. Sci.*, (2.) **7.** 420.)

SEBACIC ETHER. *Vid.* Scbate of Ethyl.

SEBACIN. Insoluble in water. Easily soluble in alcohol, ether, and the fatty oils. Scarcely at all attacked by concentrated sulphuric or nitric acid, or by an aqueous solution of caustic potash. (Petersen, *Ann. Ch. u. Pharm.*, **103.** 184.)
(Isomeric with Menthene and Camphin.)
$C_{20}H_{18}''$

SEBAMIC ACID. Readily soluble in boiling water, in alcohol, and very easily in dilute ammonia-water. (Rowney, *J. Ch. Soc.*, **4.** 336.)
(Sebacylamic Acid.)
$C_{20}H_{19}NO_6 = N\left\{\begin{matrix}C_{20}H_{16}O_4''\\ H_2\end{matrix}\right. . O, HO$

SEBAMID. Insoluble in cold, tolerably soluble in boiling water. Slightly soluble in cold, very easily soluble in boiling alcohol. Insoluble in dilute ammonia-water. (Rowney, *J. Ch. Soc.*, **4.** 335.)
(Sebacylamid.)
$C_{20}H_{20}N_2O_4 = N_2\left\{\begin{matrix}C_{20}H_{16}O_4''\\ H_4\end{matrix}\right.$

SEBATES. See above under **SEBACIC ACID.**

"**SEBATE OF** *X*"(of Thénard). *Vid.* Benzoate of *X*. (Berzelius.)

SEBIN.
(Sebate of Glyceryl (basic.).)
$C_{38}H_{30}O_{16}$

SECALIN. *Vid.* Propylamin.

SEIGNETTE SALT. *Vid.* Tartrate of Potash & of Soda.

SELALEMBROTH. *Vid.* Chloride of Ammonium & of Mercury(Hg Cl).

SELENALDIN. Sparingly soluble in water, the solution undergoing decomposition when boiled. Easily soluble in alcohol, and ether. Soluble in dilute chlorhydric acid.
$C_{12}H_{13}N\ Se_4 = N\left\{C_{12}H_{13}Se_4'''\right.$

SELENETHYL. Insoluble in water. Soluble, with decomposition, in warm, tolerably concentrated nitric acid.
(Selenide of Ethyl. Selenhydric Ether.)
$\left.\begin{matrix}C_4H_5Se\\ C_4H_5Se\end{matrix}\right\}$

SELENHYDRIC ACID. More abundantly soluble in water than sulphydric acid. This solution gradually decomposes.
(Hydro Selenic Acid. Seleniuretted Hydrogen. Selenide of Hydrogen.)
HSe

SELENHYDRATE OF ALUMINUM. Insoluble in water.

SELENHYDRATE OF AMMONIUM. Soluble in water, the solution undergoing decomposition when exposed to the air.

SELENHYDRATE OF BARIUM. Soluble in water.

SELENHYDRATE OF CALCIUM. Soluble in water. (Berzelius.)
$CaSe, HSe$

SELENHYDRATE OF ETHYL. Insoluble in water. Soluble in alcohol. (Wœhler & Siemans.)
(Ethyl Selenhydric Acid. Selenium Mercaptan.)
$C_4H_6Se_2 = C_4H_5Se, HSe$

SELENHYDRATE OF MAGNESIUM. Soluble in water. (Berzelius.)

SELENHYDRATE OF POTASSIUM. Soluble in water, the solution undergoing decomposition when exposed to the air.

SELENHYDRATE OF SODIUM. Soluble in water, the solution undergoing decomposition when exposed to the air.

SELENHYDRATE OF STRONTIUM. Soluble in water.

SELENHYDRATE OF ZINC. Insoluble in water.

SELENHYDRIC ETHER. *Vid.* SelenEthyl.

SELENIC ACID.

a = *anhydrous.* Unknown in the free state.
SeO_3

b = *hydrated.* Hygroscopic. Soluble in water, with great evolution of heat.
SeO_3, HO

All the normal and acid salts of selenic acid are soluble in water, excepting the normal salts of baryta, strontia, lime, and lead, which are nearly or quite insoluble in water, or nitric acid.

SELENIATE OF ALUMINA. Similar to the tersulphate of alumina. (Berzelius.)
$Al_2O_3, 3SeO_3$

SELENIATE OF ARGENT*bi*AMIN. Decomposes in the air. Readily soluble in water, and ammonia-water. (Mitscherlich.)
$N_2\left\{H_6 . AgO, SeO_3\right.$

SELENIATE OF BARYTA. Insoluble in water or nitric acid. (Berzelius.) It is decomposed and dissolved by long-continued boiling with chlorhydric acid. (H. Rose.)
BaO, SeO_3

SELENIATE OF COBALT.

SELENIATE OF COPPER. Soluble in water. (Dumas, *Tr.*)
CuO, SeO_3

SELENIATE OF COPPER & OF POTASH.

SELENIATE *of protoxide* **OF IRON.** Resembles sulphate of iron.
FeO, SeO_3

SELENIATE *of sesquioxide* **OF IRON.** Both the normal and basic salts resemble those of sulphuric acid.
$Fe_2O_3, 3SeO_3$

SELENIATE OF LEAD. Insoluble in water, or nitric acid. Decomposed by long-continued boiling with chlorhydric acid.
PbO, SeO_3

SELENIATE OF LIME. Its solubility is the same as that of sulphate of lime.

SELENIATE OF MAGNESIA. It resembles sulphate of magnesia in solubility. (Berzelius.)
MgO, SeO_3

SELENIATE *of dinoxide* **OF MERCURY.** Slightly soluble in water. (Kœhler.)
$6Hg_2O, 5SeO_3$

SELENIATE *of protoxide* **OF MERCURY.**

I.) $HgO, SeO_3 + Aq$ Decomposed by water to an insoluble basic salt and a sparingly soluble acid salt. (Kœhler.)

II.) $2(3HgO, SeO_3) + Aq$ Insoluble in water. Soluble in nitric, and chlorhydric acids. (Kœhler.)

SELENIATE OF NICKEL.
$NiO, SeO_3 + 7Aq$

SELENIATE OF POTASH. More soluble in water than nitrate of potash. Almost equally soluble in hot or cold water. (Mitscherlich.)
KO, SeO_3

SELENIATE OF POTASH with SULPHATE OF SODA. Soluble in water.
$KO, SeO_3; NaO, SO_3$

SELENIATE OF SILVER. Resembles the sulphate. Soluble in hot nitric acid, from which it is precipitated on the addition of water. (Berzelius.)
AgO, SeO_3

Seleniate of Soda. Its maximum point of solubility in water is at the temperature of 33°. (Mitscherlich.) It resembles sulphate of soda in its remarkable changes of solubility at different degrees of temperature. (Berzelius, *Lehrb.*)
$Na O, Se O_3 + 10 Aq$

Seleniate of Strontia. Insoluble in water, or nitric acid. Decomposed by long-continued boiling with chlorhydric acid.
$Sr O, Se O_3$

Seleniate of Zinc. Soluble in water.
$Zn O, Se O_3 + 3 \& 7 Aq$

Selenides. Among the metallic selenides, those only are soluble in water which correspond to the soluble oxides; thus, the selenides of potassium, sodium, lithium, barium, strontium, calcium, and magnesium, are soluble, while all the others are insoluble in water. (Persoz, *Chim. Moléc.*, p. 463.) The metallic selenides are more readily dissolved by nitric acid than the pure metals, excepting protoselenide of mercury (Hg Se) which is almost insoluble therein.

Selenide of Aluminum. Decomposed by water.

Selenide of Ammonium. Easily soluble in water. The aqueous solution undergoing decomposition when exposed to the air. (Bineau.)
$N H_4 Se$

Selenide of Antimony.

Selenide of Arsenic.

Selenide of Barium. Soluble in warm water, but undergoes a decomposition similar to that of sulphide of barium. (Berzelius.)

Selenide of Bismuth.

Selenide of Cacodyl. Insoluble in water. Readily soluble in alcohol, and ether. (Bunsen.)
$\left.\begin{matrix}(C_2 H_3)_2 As \\ (C_2 H_3)_2 As\end{matrix}\right\} Se_2$

Selenide of Calcium. Insoluble in water. Soluble in an aqueous solution of selenhydric acid. (Berzelius.)

Selenide of Cerium. Insoluble in water. Easily decomposed by acids. (Dumas, *Tr.*)

Selenide of Cobalt.

***Di*Selenide of Copper.**
$Cu_2 Se$

***Proto*Selenide of Copper.**
$Cu Se$

***Proto*Selenide of Copper & of Lead.**
I.) $Cu Se ; Pb Se$
II.) $Cu Se ; 2 Pb Se$
III.) $Cu Se ; 4 Pb Se$
Soluble in cold, moderately strong nitric acid, with separation of selenium. (Karsten.)

***Di*Selenide of Copper & of Silver.** Soluble in hot nitric acid, with decomposition. (Berzelius.)
$Cu_2 Se, Ag Se$

Selenide of Ethyl. *Vid.* SelenEthyl.

Selenide of Ethyl & of Mercury. Insoluble in water. Soluble in hot, less soluble in cold alcohol.
$C_4 H_5 Hg Se_2 = \left.\begin{matrix}C_4 H_5 \\ Hg\end{matrix}\right\} Se_2$

Selenide of *tri*EthylPhosphin. Soluble in water. (Hofmann & Cahours.)
$P \left\} (C_4 H_5)_3, Se_2\right.$

Selenide of Furfuryl. Very easily decomposed.
(*SelenioFurful. Furfurolseleniè.*)
$C_{10} H_4 O_2'' \left\} Se_2\right.$

Selenide of Glucinum. Slowly soluble in water, without decomposition.

Selenide of Iron. Soluble in chlorhydric acid, with decomposition.
$Fe Se$

Selenide of Lead. Difficultly attacked by nitric acid. Soluble in aqua-regia. (Dumas, *Tr.*)
$Pb Se$

Selenide of Lead & of Mercury.

Selenide of Magnesium. Insoluble in water, but soluble in an aqueous solution of selenhydric acid. (Berzelius.)

Selenide of Manganese. Insoluble in water.

Selenide of Mercury. Almost insoluble in hot nitric acid. Soluble in cold aqua-regia. When recently precipitated it dissolves in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 317.)

Selenide of Mercury with Sulphide of Mercury. Unacted upon by chlorhydric, or nitric acids. Soluble, with decomposition, in aqua-regia.
$Hg Se ; 4 HgS$

Selenide of Methyl. *Vid.* SelenMethyl.

Selenide of *tri*MethylPhosphin.
$P \left\} (C_2 H_3)_3 Se_2\right.$

Selenide of Palladium.

Selenide of Phosphorus. Partially decomposed by water. Decomposed by alkaline solutions.

Selenide of Platinum.

Selenide of Potassium. Slowly hygroscopic. Easily soluble in water, the solution undergoing decomposition when exposed to the air.
$K Se$

Selenide of Silver.

I.) *proto.* Soluble, with decomposition, in boiling nitric acid. (Berzelius.) Insoluble in an aqueous solution of protonitrate of mercury. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 317.)
$Ag Se$

II.) *bi.*
$Ag Se_2$

Selenide of Sodium. Soluble in water, the solution undergoing decomposition when exposed to the air.

Selenide of Stib*tri*Ethyl. Decomposes in the air. Resembles the sulphide.
$Sb \left\} (C_4 H_5)_3, Se_2\right.$

Selenide of Strontium. Soluble in an aqueous solution of selenhydric acid.
$Sr Se$

Selenide of Sulphur.

I.) $S_2 Se$ Decomposed, with partial solution, by hot aqueous solutions of caustic potash and of sulphydrate of potassium.

II.) $S_3 Se$ Entirely soluble, with decomposition, in aqueous solutions of the caustic alkalies.

Selenide of Tin.

Selenide of Yttrium. Not decomposed by water. Decomposed by acids.

Selenide of Zinc. Insoluble in water.

SelenioCyanhydric Acid. Soluble in water, the solution easily undergoing decomposition, especially when it is evaporated or boiled. Also decomposed by acids. (Crookes.)
(*HydroSelenioCyanic Acid.*)
$C_2 H N Se_2 = Cy Se, H Se$

SelenioCyanide of Ammonium. Very deliquescent. Soluble in water. (Crookes.)
$N H_4 Se, Cy Se$

SelenioCyanide of Barium. Very soluble in water.
$Ba Se, Cy Se$

SelenioCyanide of Copper. Ppt. Very alterable.
$Cu Se, Cy Se$

SelenioCyanide of Iron. Soluble in absolute alcohol. (Crookes.)

SelenioCyanide of Lead. Soluble, with slight decomposition, in boiling water. Less soluble in cold water. Insoluble in alcohol. (Crookes, *J. Ch. Soc.*, **4.** 16.)
$Pb Se, Cy Se$

SelenioCyanide of Lime. Soluble in water.
$Ca Se, Cy Se$

SelenioCyanide of Magnesium. Soluble in water.
$Mg Se, Cy Se$

SelenioCyanide of Potassium. Very deliquescent, and soluble in water, with great depression of temperature. More soluble in water than sulphocyanide of potassium. Soluble in alcohol. (Crookes, *J. Ch. Soc.*, **4.** 13.) Easily decomposed by acids.
$K Se, Cy Se$

SelenioCyanide of Silver. Insoluble in water. Almost insoluble in ammonia-water, or in cold weak acids. Instantly decomposed by strong boiling acids. (Crookes, *loc. cit.*, p. 15.)
$Ag Se, Cy Se$

SelenioCyanide of Sodium. Very soluble in water. (Crookes.)
$Na Se, Cy Se$

SelenioCyanide of Strontium. Soluble in water.
$Sr Se, Cy Se$

SelenioCyanide of Zinc. Permanent. Soluble in water.
$Zn Se, Cy Se$

SelenioFurfol (or Furfurol). *Vid.* Selenide of Furfuryl.

Selenious Acid

a = *anhydrous.* Liquefies when exposed to the air. (Muspratt, *J. Ch. Soc.*, **2.** 54.) Easily soluble in water, dissolving in almost all proportions in boiling water. Easily and abundantly soluble in alcohol. (Berzelius, *Lehrb.*, **2.** 206.)
$Se O_2$

b = *hydrated.* Easily soluble in water, alcohol, and nitric acid. (Berzelius.) Insoluble in caoutchin. Most of the protoselenites ($M O, Se O_2$), excepting those of the alkalies, are insoluble in water; but the bi and quadri selenites ($M O, 2 Se O_2$ and $M O, 4 Se O_2$) are easily soluble in water. All the metallic selenites are soluble in nitric acid, though the salts of lead and silver dissolve with great difficulty. Chlorhydric acid has no action upon them.
$Se O_2, H O$

Selenite of Alumina.

I.) *ter.* Insoluble in water. Soluble in selenious acid. (Berzelius.)
$Al_2 O_3, 3 Se O_2 + 3 Aq$

II.) *acid.* Easily soluble in water. (Berzelius.)

Selenite of Ammonia.

I.) *proto.* Deliquescent. Extremely soluble in water, from which solution it is precipitated on the addition of alcohol. Perfectly insoluble in ether. (Muspratt, *J. Ch. Soc.*, **2.** 59.)
$N H_4 O, Se O_2$

II.) *bi.* Permanent. Soluble in water.
$N H_4 O, 2 Se O_2$

III.) *quadri.* Deliquescent. Soluble in water. (Berzelius.)
$N H_4 O, 2 Se O_2$

Selenite of Baryta.

I.) *proto.* Insoluble in water. (Gm.) Soluble in selenious, chlorhydric, and nitric acids. (Muspratt, *loc. cit.*, p. 60.)
$Ba O, Se O_2$

II.) *bi.* Difficultly soluble in water. (Muspratt, *loc. cit.*)
$Ba O, 2 Se O_2$

Selenite of Cadmium. Soluble in selenious acid. (Muspratt, *loc. cit.*, p. 66.)

Selenite *of protoxide* **of Cerium.**

I.) *proto.* Insoluble in water. Soluble in selenious acid, and in nitric acid.
$Ce O, Se O_2$

II.) *bi.* Soluble in water.

Selenite *of sesquioxide* **of Cerium.**

I.) *normal.* Soluble in selenious acid.
$Ce_2 O_3, 3 Se O_2$

II.) *acid.* Soluble in water. (Berzelius; Muspratt.)

Selenite *of sesquioxide* **of Chromium.**

I.) *ter.* Soluble in selenious acid. (Muspratt.)
$Cr_2 O_3, 3 Se O_2$

Selenite of Cobalt.

I.) *proto.* Insoluble in water. (Berzelius.)
$Co O, Se O_2$

II.) *bi.* Soluble in water. (Muspratt.)
$Co O, 2 Se O_2$

Selenite *of dinoxide* **of Copper.**

I.) *proto.* Insoluble in water. (Berzelius.) Soluble in ammonia-water. (Dumas, *Tr.*)
$Cu_2 O, Se O_2$

Selenite *of protoxide* **of Copper.**

I.) *proto.* Insoluble in water, or selenious acid. (Berzelius; Muspratt, *loc. cit.*, p. 66.)
$3 (Cu O, Se O_2) + Aq$

II.) *basic* (*green ppt.*). Insoluble in water. Soluble in ammonia-water. (Muspratt, *J. Ch. Soc.*, **2.** 66.)

Selenite of Glucina.

I.) *normal.* Insoluble in water. (Berzelius, *Lehrb.*, **3.** 495.)
$Gl_2 O_3, 3 Se O_2$

II.) *acid.* Extremely soluble in water. (Muspratt, *loc. cit.*) Soluble in water. (Berzelius.)
$Gl_2 O_3, 6 Se O_2$

Selenite *of protoxide* **of Iron.**

I.) *proto.* When freshly precipitated it is soluble in chlorhydric, and selenious acids. Soluble in nitric acid.
$Fe O, Se O_2$

II.) *bi.* Slightly soluble in water. (Berzelius.)

Selenite *of sesquioxide* **of Iron.**

I.) *sesqui.* Insoluble in water.

II.) *ter.* Ppt.
$Fe_2 O_3, 3 Se O_2 + 4 Aq$

III.) *sexi* or "*bi.*" Insoluble in water. Soluble in chlorhydric acid. (Berzelius.)
$Fe_2 O_3, 6 Se O_2$

Selenite of Lead.

I.) *mono.* Slightly soluble in water. (Muspratt.) Scarcely at all soluble in water, even when this is acidulated with selenious acid. Difficultly soluble in warm nitric acid. (Berzelius.)
$Pb O, Se O_2$

Selenite of Lime.

I.) *proto.* Very sparingly soluble in water; more soluble in selenious acid.
$Ca O, Se O_2$

II.) *bi.* Permanent. Soluble in water.
$Ca O, 2 Se O_2$

Selenite of Lithia. Deliquescent. Soluble in selenious acid. (Muspratt.)
$Li O, Se O_2$

Selenite of Magnesia.

I.) *proto.* Soluble in boiling water, and in selenious acid. (Muspratt, *loc. cit.*, p. 61.) Difficultly soluble in water, requiring much boiling water to dissolve it. (Berzelius, *Lehrb.*, **3.** 457.)
$Mg O, Se O_2 + 3 Aq$

II.) *bi.* $Mg O, 2 Se O_2$ Extremely deliquescent. Soluble in water. Insoluble in alcohol. (Muspratt, *loc. cit.*)

Selenite of Manganese.

I.) *proto.* $Mn O, Se O_2 + 2 Aq$ Insoluble in water. Soluble in chlorhydric acid. (Muspratt, *loc. cit.*, p. 64.)

II.) *bi.* $Mn O, 2 Se O_2$ Readily soluble in water. (Berzelius.)

Selenite *of dinoxide* **of Mercury.**

I.) *proto.* $Hg_2 O, Se O_2$ Insoluble in water, or selenious acid. Partially soluble, with decomposition, in chlorhydric acid, and in an aqueous solution of caustic potash. (Berzelius.)

Selenite *of protoxide* **of Mercury.**

I.) *proto.* $Hg O, Se O_2$ Insoluble in water. (Muspratt.) Insoluble, or very sparingly soluble, in water. Somewhat soluble in selenious acid. (Berzelius.)

II.) *bi.* $Hg O, 2 Se O_2 + x Aq$ Easily soluble in water Very slightly soluble in alcohol. Soluble in ammonia-water. (Berzelius.)

Selenite of Nickel

I.) *proto.* $Ni O, Se O_2 + Aq$ Insoluble in water. (Berzelius.) Soluble in selenious acid. (Muspratt.)

II.) *bi.* Soluble in water. (Berzelius.).

Selenite of Potash.

I.) *proto.* $K O, Se O_2$ Deliquescent. Remarkably soluble in water. Almost insoluble in alcohol. (Muspratt, *J. Ch. Soc.*, **2.** 55.)

II.) *bi.* $K O, 2 Se O_2 + Aq$ Deliquescent. Very soluble in water. Only slightly soluble in alcohol. (Muspratt, *J. Ch. Soc.*, **2.** 56.)

III.) *quadri.* $K O, 4 Se O_2$ Very deliquescent. Soluble in water, from which it is precipitated on the addition of alcohol. (Muspratt, *loc. cit.*)

Selenite of Silver. $Ag O, Se O_2$ Very sparingly soluble in cold, somewhat more freely soluble in hot water. Easily soluble in nitric acid, from which it is precipitated on the addition of water. (Berzelius.) Easily soluble in hot nitric acid, from which it separates as the solution cools. (Muspratt.)

Selenite of Soda.

I.) *proto.* $Na O, Se O_2$ Permanent. Extremely easily soluble in water. Insoluble in alcohol. (Muspratt, *loc. cit.*, p. 57.)

II.) *bi.* $Na O, 2 Se O_2 + 3 Aq$ Permanent. Easily soluble in water.

III.) *quadri.* $Na O, 4 Se O_2 + 4 Aq$ Not very deliquescent. Soluble in selenious acid. (Muspratt.)

Selenite of Strontia.

I.) *proto.* $Sr O, Se O_2$ Insoluble in water. Soluble in nitric acid. (Muspratt.)

II.) *bi.* $Sr O, 2 Se O_2$ Slightly soluble in water. (Muspratt.) Scarcely at all soluble in cold, and very slightly soluble in boiling water. (Berzelius.)

Selenite *of binoxide* **of Tin.** $Sn O_2, 2 Se O_2$ Insoluble in water. Soluble in chlorhydric acid, from which it is reprecipitated on the addition of water.

Selenite *of sesquioxide* **of Uranium.**

I.) *proto.* $Ur_2 O_3, Se O_2$ Ppt.

II.) *bi.* Soluble in water. (Berzelius.)

Selenite of Yttria. $Y O, Se O_2$ Insoluble in water, or selenious acid. (Berzelius.)

Selenite of Zinc.

I.) $Zn O, Se O_2 + 2 Aq$ Insoluble in water. Soluble in selenious and nitric acids. (Muspratt.)

II.) *bi.* Easily soluble in water. (Berzelius.)

III.) *quadri.* $Zn O, 4 Se O_2 + 3 Aq$ Permanent. Easily soluble in water. (Wœhler.)

Selenite of Zirconia. $Zr_2 O_3, 3 Se O_2$ Insoluble in water. Soluble in selenious acid. (Berzelius; Muspratt, *loc. cit.*)

Selenium. Se Insoluble in water. Concentrated sulphuric acid, especially when gently heated, dissolves it rapidly and in large quantities; from this solution it is precipitated on the addition of water. (Magnus.) Soluble in concentrated sulphuric acid, which contains free $S O_3$, without decomposition, and in warm ordinary oil of vitriol, with partial decomposition. (L. Gmelin.) Soluble in dichloride of sulphur. (P. & F.) Sparingly soluble in boiling, almost insoluble in cold creosote. (Reichenbach.) Soluble in the fatty oils, but insoluble in essential oils. Insoluble in caoutchin. Soluble in aqueous solutions of the caustic alkalies, from which it is gradually reprecipitated when these are exposed to the air. Insoluble in chlorhydric acid. Only slightly acted upon by cold, tolerably easily soluble in hot nitric acid; still more easily soluble in aqua-regia, with formation of selenious acid in either case. It is more readily soluble than sulphur in these acids.

Two allotropic modifications of selenium are admitted by several chemists: —

I.) *ElectroNegative Selenium.* Soluble in bisulphide of carbon. (Berthelot.) Soluble in boiling benzin, and in bisulphide of carbon. (Charles Deville, *Ann. Ch. et Phys.*, (3.) **47.** 106.)

II.) *ElectroPositive Selenium.* Insoluble in bisulphide of carbon (C. Deville; Berthelot), or in boiling benzin. (C. Deville.)

Selenium Mercaptan. *Vid.* EthylSelenhydric Acid.

Seleniuretted Hydrogen. *Vid.* Selenhydric Acid.

Selen Methyl. (*Selenide of Methyl.*) $\left.\begin{matrix}C_2 H_3 Se\\ C_2 H_3 Se\end{matrix}\right\}$ Insoluble in water. Soluble, with decomposition, in strong nitric acid. (Wœhler & Dean, *Ann. Ch. u. Pharm.*, **97.** 6.)

SelenoCyanide of *X.* *Vid.* SelenioCyanide of *X.*

SemiBenzidam. *Vid.* AzoPhenylamin.

SemiNaphthalidam. *Vid.* AzoNaphtylamin.

Senegin. }
Seneguin. } Identical with Saponin, *q. v.*

Sepeerin (from *Nectandra rodiei*). (*Sepirin.*) [Bebeeru bark]. Very sparingly soluble in water. Easily soluble in weak and in strong alcohol. Insoluble in ether. Soluble in acids. (Maclagan.)

Sepeerin was distinguished from beberin by Maclagan, on the ground that it is insoluble in ether; but Tilley subsequently maintained that this sepeerin was nothing but impure beberin.

Septem. See *septem*, as prefix, under the generic name of the substance sought for.

Serolin. Insoluble in water. Very sparingly soluble in cold, somewhat more easily soluble in hot alcohol. Easily soluble in ether. Not saponified by caustic alkalies. Soluble in the serum of blood. (Boudet.)

SesquiCarbonate(&c.) of *X*. See under Carbonate(&c.) of *X*, as *sesqui*Carbonate of *X*, *sesqui*Chloride of *X*, and the like.

Sex. See *sex*, as prefix, under the generic name of the substance sought for.

Shellac. See under Resins.

Silicic Acid. Exists under two or more allotropic modifications: —

(*Silica.*)
$Si O_2$*

I.) *Insoluble modification* (α $Si O_2$).

a = crystallized. Occurs as *Quartz*, and several other minerals. Insoluble in water or in acids, excepting fluorhydric acid, by which it is readily dissolved. Only slightly soluble in boiling potash-lye. Flint or quartz enters into solution when boiled with aqueous solutions of caustic alkalies, under strong pressure. When finely powdered and boiled with aqueous solutions of the caustic or carbonated fixed alkalies it gradually changes to $bSi O_2$ and dissolves.

When pounded rock-crystal is boiled to dryness with three several quantities of potash-lye (till in fact nothing but hydrate of potash remains) solution is effected. (Lœwitz, *Crell's Ann.*, 1799, **2.** 375 [*Gm.*].)

Contrary to the assertion of Verdeil & Risler, quartz is completely insoluble in sugar-water. (Petzholdt, *J. pr. Ch.*, 1853, **60.** 368.)

b = amorphous. Obtained by evaporating a solution of the soluble modification of silicic acid in water or any volatile acid, excepting fluorhydric acid, and thoroughly drying the residue. It is insoluble in water or acids, with the exception of fluorhydric acid, but dissolves in potash-lye and in solutions of the fixed alkaline carbonates. The mineral opal and its varieties appears to belong under this head. Opal is not attacked by acids, with the exception of fluorhydric acid, which dissolves it more easily than quartz; when powdered it dissolves in boiling potash-lye. (Fuchs.) When an aqueous solution of water-glass (acid silicate of soda or potash) is evaporated to dryness, and the water wholly expelled from the residue by ignition a part of the silica goes over into the passive, insoluble state. Fremy found that after water-glass, of composition $R O, 4\frac{1}{2} Si O_2$, has been carefully dried, water dissolves the alkali out of the residue, and leaves the silica, which last, according as the heat has been more or less intense, is or is not soluble in dilute alkalies. (Ordway, *Am. J. Sci.*, (2.) **32.** 342.)

According to Fuchs, and Bischof, the mineral *Chalcedony* is a mixture of quartz and opal, the latter being dissolved, and the former left behind, when the mineral is boiled with potash-lye; dilute fluorhydric acid also dissolves out the opal faster than the quartz. According to W. B. & R. E. Rogers (*Am. J. Sci.*, 1848, (2.) **5.** 403), chalcedony is dissolved to a certain extent by carbonic acid-water.

II.) *Soluble modification.*(β $Si O_2$). The gelatinous hydrate, but not the powdery hydrate to

---

*Formulæ in which silicic acid is expressed as $Si O_2$ may be readily converted into those in which it is regarded as $Si O_3$, by multiplying all of the terms of the $Si O_2$ formula by 3, and then correcting the silicic acid term in the product, in accordance with the fact that $1 Si O_2 = \frac{2}{3} Si O_3$.

Conversely, to change $Si O_3$ formulæ to those of $Si O_2$ divide each term by 3, and correct for $1 Si O_3 = \frac{3}{2} Si O_2$.

The case in which water of crystallization is present is, of course, included in this rule. The same rule, moreover, applies to formulæ in which the silicic acid is written $Si O$; it being only necessary to remember that one equivalent of $Si O$ equals $\frac{1}{2} Si O_2$ or $\frac{1}{3} Si O_3$.

For convenient comparison, the following tables of some of the more commonly occurring silicates is added: —

$Si O_2$	**$Si O_3$**	**$Si O$**
(Equiv. Si = 14)	(Equiv. Si = 21)	(Equiv. Si = 7)
$Si O_2$	$\frac{2}{3} Si O_3$	$2 Si O$
$R O, Si O_2$	$3 R O, 2 Si O_3$	$R O, 2 Si O$
ditto + Aq	ditto + 3 Aq	ditto + Aq
$R O, 2 Si O_2$	$3 R O, 4 Si O_3$	$R O, 4 Si O$
$R O, 3 Si O_2$	$R O, 2 Si O_3$	$R O, 6 Si O$
$R O, 4 Si O_2$	$3 R O, 8 Si O_3$	$R O, 8 Si O$
$2 R O, Si O_2$	$3 R O, Si O_3$	$R O, Si O$
$2 R O, 3 Si O_2$	$R O, Si O_3$	$R O, 3 Si O$
$2 R O, 9 Si O_2$	$R O, 3 Si O_3$	$R O, 9 Si O$
$3 R O, Si O_2$	$9 R O, 2 Si O_3$	$3 R O, 2 Si O$
$3 R O, 2 Si O_2$	$9 R O, 4 Si O_3$	$3 R O, 4 Si O$
$3 R O, 4 Si O_2$	$9 R O, 8 Si O_3$	$3 R O, 8 Si O$
$4 R O, 3 Si O_2$	$2 R O, Si O_3$	$2 R O, 3 Si O$
$4 R O, 9 Si O_2$	$2 R O, 3 Si O_3$	$2 R O, 9 Si O$

$Si O_3$	**$Si O_2$**	**$Si O$**
(Equiv. Si = 21)	(Equiv. Si = 14)	(Equiv. Si = 7)
$Si O_3$	$\frac{3}{2} Si O_2$	$3 Si O$
$R O, Si O_3$	$2 R O, 3 Si O_2$	$R O, Si O$
ditto + Aq	ditto + 2 Aq	ditto + Aq
$R O, 2 Si O_3$	$R O, 3 Si O_2$	$R O, 6 Si O$
$R O, 3 Si O_3$	$2 R O, 9 Si O_2$	$R O, 9 Si O$
$R O, 4 Si O_3$	$R O, 6 Si O_2$	$R O, 12 Si O$
$2 R O, Si O_3$	$4 R O, 3 Si O_2$	$2 R O, 3 Si O$
$2 R O, 3 Si O_3$	$4 R O, 9 Si O_2$	$2 R O, 9 Si O$
$3 R O, Si O_3$	$2 R O, Si O_2$	$R O, Si O$
$3 R O, 2 Si O_3$	$R O, Si O_2$	$R O, 2 Si O$
$3 R O, 4 Si O_3$	$R O, 2 Si O_2$	$R O, 4 Si O$
$3 R O, 8 Si O_3$	$R O, 4 Si O_2$	$R O, 8 Si O$
$4 R O, 3 Si O_3$	$8 R O, 9 Si O_2$	$4 R O, 9 Si O$
$9 R O, 4 Si O_3$	$3 R O, 2 Si O_2$	$3 R O, 4 Si O$

which it is converted when dried in the air, is somewhat soluble in water, and in chlorhydric acid, the degree of this solubility being dependent on whether the hydrate has just been precipitated or has already become compact.

As obtained by passing fluosilicic acid gas into water, and thoroughly washing the precipitate, it is soluble, while still moist, in 7700 pts. of water, and in 11000 pts. of cold, or 5500 pts. of boiling chlorhydric acid of 1.115 sp. gr. (J. Fuchs, cited by Fresenius, *Quant.*, p. 164; also in *J. pr. Ch.*, 1852, **57.** 382.) Hydrated silicic acid is soluble in 1000 pts. of water. (Kirwan.)

When prepared by the decomposition of fluosilicic acid ($Si\ Fl_2$) by water it dissolves in considerable quantity in water, forming a solution which may be evaporated to dryness, and the acid obtained as a powder which is still soluble in water; but if the solution be acidified with sulphuric or chlorhydric acid before being evaporated, the silicic acid obtained will be in the insoluble modification. (Berzelius.)

By allowing crystallized boracic acid to absorb gaseous fluoride of silicon, and then separating the excess of fluorhydric and boracic acids by digestion with a large excess of ammonia-water, a hydrate of silicic acid is obtained, which, after being thoroughly purified from the adhering acid, is very soluble in water. This solution gives no precipitate when boiled, but when evaporated to dryness the $Si\ O_2$ is left in the insoluble state. (Berzelius.)

When sulphide of silicon is mixed with water it undergoes decomposition, with evolution of sulphuretted hydrogen, but the $Si\ O_2$ formed does not separate; it all remains dissolved in the water. This solution of $Si\ O_2$ is often of great stability; when dilute it can be preserved for months without depositing $Si\ O_2$, but becomes gelatinous and deposits $Si\ O_2$ if it is evaporated, boiled, or mixed with soluble alkaline salts. After being evaporated to dryness, the $Si\ O_2$ is no longer soluble in water. The solution of $Si\ O_2$ above described is generally more stable than that obtained by dissolving hydrated silica in acids. (Fremy, *Ann. Ch. et Phys.*, (3.) **38.** 317.)

In the decomposition by acids of minerals, &c., containing silica, more or less of the latter usually goes into solution, and it is often exceedingly difficult to remove the last traces of this dissolved silica. (C. J. B. Karsten, *Pogg. Ann.*, 1826, **6.** 351.) On the addition to *liquor silicum* (basic silicate of potash) of an acid in quantity not sufficient for saturation, there is precipitated a compound of the potash, with excess of silica; a larger quantity of acid throws down the silica in the form of a gelatinous hydrate, leaving in solution a quantity of silica, which is greater in proportion to the degree of dilution and to the excess of acid employed. (Dalton.)

It has long been known that silica, after it has once been brought into solution by means of alkalies or acids, is somewhat soluble in pure water. More surprising, however, is the fact that this solubility is increased by the presence of a free acid; indeed, it can hardly be doubted that chemical combination between the silica and acid actually occurs. As a matter of universal experience, it is known that a concentrated aqueous solution of an alkaline silicate is immediately decomposed when an excess of acid is added to it, the silica separating out almost completely without being redissolved by the acid, no matter in how large excess the latter may have been added. But a solution of the same alkaline silicate, when diluted with a sufficient quantity of water, can no longer be thus decomposed by the addition of an excess of acid; on the contrary, it remains perfectly clear after such addition, and deposits none of its silica until it has been concentrated by evaporation, and the silica thereby rendered gelatinous. Thus, if an alkaline silicate be dissolved in such an amount of water that there shall be about 30 pts. of the latter to one part of silica, and an acid then added to the solution in no greater quantity than will suffice to neutralize it precisely, the liquor will remain clear for a considerable space of time, but gradually becomes cloudy, and by degrees deposits silica; and this precipitate cannot now be redissolved by the addition of more acid, or at least only insignificant quantities of it can be thus dissolved. But if, on the other hand, the point of neutrality be immediately overstepped before any cloudiness has manifested itself in the liquor, the solution will remain permanently clear, no silica being deposited even after the lapse of many weeks. This result is obtained alike with sulphuric, nitric, chlorhydric, and acetic acids. The question might arise, whether these solutions should not be regarded simply as solutions of silica in water, and the precipitation which occurs when an acid is added to concentrated liquors attributed to the want of a sufficient quantity of the solvent water; it being known that silica, when once separated from a solution, is either absolutely insoluble, or only exceedingly sparingly soluble in water and dilute acids. But if this were true, it would follow that at the ordinary temperature silica is soluble in about 25 @ 30 pts. of water; for a solution of an alkaline silicate need not be diluted more strongly than this, in order to prevent precipitation by acids. Nor would the reason be evident why silica should be precipitated by acids from the most dilute solutions of alkaline silicates, in spite of the large amount of water present, unless more acid is added than is required to saturate the alkali. If the water alone act as the solvent, it must, of course, be a matter of indifference whether or no the acid be present in excess. It cannot, therefore, be doubted but that the excess of acid exerts a greater influence than the water in retaining the silica in solution; and that water alone has no power to hold in solution such considerable quantities of silica. Why the silica, after having once actually separated, owing to insufficient dilution of the solution, should no longer be soluble even in the largest excess of concentrated or dilute acids, is a question which would appear to be inexplicable by chemical reasons. That it is really the acid and not the water which holds the silica in solution follows, moreover, from the fact that salts may be dissolved in the liquor resulting from the addition of an excess of acid to a solution of an alkaline silicate, even to its complete saturation, without occasioning any separation of silica. If those salts are employed which dissolve in water at a somewhat elevated temperature in much more considerable quantity than at the ordinary temperature, then that portion of the salt which can no longer be held in solution as the liquor becomes cold will separate out as the temperature falls, but the silica will still remain in the solution. For example, in a solution of an alkaline silicate to which an excess of nitric acid has been added, so much nitrate of potash may be dissolved by the application of heat that a large portion crystallizes out again on cooling; and yet no cloudiness occurs in the liquid and no silica is deposited. (C. J. B. Karsten, *Pogg. Ann.*, 1826, **6.** pp. 353 –

359.) According to Bergman (*Opusc.*, **3.** 315), the solution of silica in acidulated water becomes turbid immediately on boiling. [*Gm.*]

When a dilute acid is added to a weak aqueous solution of an alkaline silicate there is no immediate precipitation of silica; but after some time the whole gelatinizes. With sulphuric acid the coagulation comes on soon; but with chlorhydric acid the change is delayed a long time, and the mixture may sometimes even be heated and partially evaporated, and still remain liquid. With nitric acid, the tendency to produce gelatinization is still less marked than with chlorhydric acid. An excess of nitric or chlorhydric acid added to very dilute waterglass (acid silicate of soda or potash), causes no apparent change for a long time. (Ordway, *Am. J. Sci.*, (2.) **32.** pp. 340, 164; **33.** 32.)

Even carbonic acid is capable of holding silica in solution, as might indeed be inferred from what is known of the solvent power of an acid so weak as acetic. This may very easily be shown by treating a dilute solution of an alkaline silicate with a large excess of any acid, for example, chlorhydric acid, and then, at the lowest possible temperature, neutralizing the clear liquid with carbonate of ammonia. The carbonic acid which is disengaged by this process dissolves in the water; and if the neutral liquor be put in a well-closed glass, it may be preserved for several weeks without the least deposition of silica, but on standing in the air, or more quickly on being heated in an open vessel, the solution decomposes in proportion as carbonic acid escapes, silica being deposited. (C. J. B. Karsten, *Pogg. Ann.*, 1826, **6.** 359.)

When silicic acid is precipitated from an alkaline solution by means of an acid, it may dissolve wholly, in part, or not at all in the excess of acid. These circumstances depend upon the state of concentration and on the manner in which the acid is added. If chlorhydric acid be slowly added, by small portions to a very concentrated solution of silicate of potash, the SiO_2 is precipitated, almost entirely, in the insoluble state. If the solution of silicate of potash be diluted, the amount of SiO_2 retained in solution will be increased.

10 c. c. of a solution of silicate of potash marking °B.	Being treated drop by drop, with H Cl till the latter was in excess.		Relation between the quantity of dissolved SiO_2 and the whole quantity of the SiO_2.
	precipitated grms. of SiO_2	quantities of SiO_2 retained in solution.	
36°	1.279 grs.	0.120	0.085
24°	0.843	0.080	0.086
21°	0.434	0.120	0.216
16°	0.280	0.162	0.366
12°	0.169	0.110	0.394
8°	0.129	0.092	0.410
6°	0.000	0.139	

These quantities must not be considered as absolutely correct, being offered merely as approximations to the truth. (Doveri, *loc. inf. cit.*, p. 42.) If, on the other hand, all the chlorhydric acid be added at once, and in large quantity, all the SiO_2 remains dissolved. A similar result is obtained when the silicate of potash is added to the chlorhydric acid, and this too whether the solutions be concentrated or dilute. If, however, solutions of silicate of potash, so dilute that the acid can no longer produce a precipitate in them, — for example, a solution of 6° B., — be taken, and so much chloride of potassium dissolved therein that the density of the solution shall be raised to 36° B., the addition of chlorhydric acid will precipitate silicic acid. A similar precipitation occurs when a concentrated solution of silicate of potash is poured into an excess of a dilute solution of chlorhydric acid which has been rendered sufficiently dense by means of chloride of potassium. Silicic acid is dissolved by acids only when it is in the nascent state; after having once been precipitated it cannot be redissolved. It is an error of Berzelius and others, that silica, precipitated from fluosilicic acid, is soluble in acids; for these only render it transparent, but do not dissolve it. A good means of obtaining a concentrated solution of silicic acid in chlorhydric acid consists in dissolving precipitated silicate of protoxide of copper in chlorhydric acid, and then precipitating the copper by means of sulphuretted hydrogen. (Doveri, *Ann. Ch. et Phys.*, (3.) **21.** 40.) In like manner, if a solution of nitrate of silver, acetate of lead, sulphate of iron, or some other metallic salt (instead of sulphate of copper) be poured into the solution of an alkaline silicate, an abundant precipitate of mixed silicic acid and the metallic silicate may be obtained. These metallic silicates are entirely soluble in dilute acids, and furnish a convenient means of obtaining concentrated solutions of silica in acids. (Doveri, *loc. cit.*, pp. 51, 52.)

Though the more or less easy solubility of silicic acid in water, and many acids is well known, the fact that very considerable quantities of it may be thus dissolved seems to be less generally accepted. Even after it has assumed the condition of a jelly, it is easy to prepare from it solutions containing 5 per cent or more, which are perfectly permanent. In making such solutions the chief point is, that the gelatinous acid to be acted upon shall be obtained in a condition as extended as possible, and be maintained, as it were, in the nascent state until it is ready to be dissolved. For this purpose an aqueous solution of silicated alkali (commercial waterglass) is diluted until it contains no more than 3% of silica, and then treated at the ordinary temperature with chlorhydric acid of 1.1 @ 1.13 sp. gr., the mixture being stirred violently, and the acid added as rapidly as possible until an excess of it is present; the excess of acid is now carefully neutralized with new portions of the solution of alkaline silicate, until only a slight trace of free acid remains. As the point of neutralization is approached the liquid becomes slightly milky and exhibits a yellowish-red opalescence,* at the first appearance of which, or better just before it appears, the addition of the alkaline solution should cease, lest a thick jelly be suddenly formed; the liquid should then be slowly heated to a temperature not exceeding 31.25°, the heat being maintained as uniform as possible by means of constant stirring. Under these circumstances, gelatinization usually occurs in the course of the first half-hour, and long before the temperature has risen to 31°. The jelly obtained is, in the first few seconds of its existence, exceedingly loose and only slightly coherent, but in a very short time, if left to itself, it acquires a more compact consistence, which is adverse to its solubility. Hence the first moment of its formation must be carefully observed, and as soon as this occurs, the whole mixture must be quickly poured into half its weight of cold water, contained in another vessel, in order to prevent, as much as possible, the further progress of the gelatinization, though this is not always to be entirely avoided. The best result, i. e. a completely soluble jelly, is obtained when the neutralization of the liquid above described is not carried to the point of opalescence; in which event the gelatinization, on the application of heat, takes place somewhat later than in the case described, in which, for the sake of rapidity, opalescence was induced, and also progresses more slowly after it has begun, so that it is easy to stop the process at the right moment, and obtain the jelly in a suitable condition. The attenuated jelly thus obtained is thrown upon a filter of open cotton cloth, like lawn, tied across one end of a glass cylinder, and washed with cold water until the foreign salts are removed; the process of washing should be a continuous one, and the jelly must be kept constantly covered with water in order to prevent it from contracting. When prepared with proper care, the washed jelly is completely soluble in boiling water, and to a considerable extent in cold water. In order to dissolve it it should be mixed with an equal volume of water, and the whole boiled during 12 @ 16 hours in a deep flask, water being added from time to time in order to replace that which evaporates, at the end of which time all of it will have passed into solution excepting a few small particles which have accidentally acquired a somewhat too strong coherence. Somewhat more consistent jellies than that now described will indeed afford weak solutions, but the greater portion will remain as an insoluble residue. The strong solution above described may be concentrated by boiling it down in a deep vessel, care being taken to avoid unnecessary contact with the air, it being easy to obtain in this way solutions which contain 6% and more of silicic acid; these may be preserved, unchanged, in well-closed bottles. These solutions, according to their degree of concentration are more or less opalescent or perfectly clear; the opalescence appearing to indicate that the silicic acid may be in a sort of intermediate condition between mere suspension and actual solution [*pseudo-solution* of Selmi]. By operating over sulphuric acid, or in a vacuum, the concentration may be pushed still further, solutions containing 10% and more of silica being easily obtained, and if protected against loss of water these may be subjected to long-continued boiling without gelatinizing. The 10% solution is of a thickish, oily consistence, but is readily miscible with water. When alcohol is added to the solution containing 5% of silicic acid, a portion of the latter is precipitated as a soft, very light powder, which is deposited with difficulty. Sulphuric acid coagulates the solution. An amorphous powder is deposited when the solution freezes; and none of these precipitates are soluble like the original jelly, any more than the residues which are obtained by evaporating the above solutions. The soluble jelly dissolves much more rapidly in ammonia-water than in pure water; but by long-continued boiling the ammonia appears to be expelled, and the solution thus obtained behaves like the aqueous solution. These aqueous solutions of silica have no action on the color of litmus; their taste is somewhat astringent, but not in the least acid. (H. Kuehn, *J. pr. Ch.*, 1853, **59.** pp. 1 – 6.)

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* This cloudiness disappears on the addition of a few drops of acid.

A sample of silicic acid, prepared by passing a current of carbonic acid through a solution of soluble glass, washing the gelatinous precipitate first with water, then with cold dilute chlorhydric acid, and finally again with water, until all the chlorhydric acid was removed, tested while still moist, had the following solubility: 100 pts. of pure water dissolved 0.021 pt. of it. 100 pts. of water, through which, as it was in contact with the silicic acid, an uninterrupted stream of carbonic acid was passed during a week, dissolved 0.0136 pt. of $Si O_2$. 100 pts. of dilute chlorhydric acid, of 1.088 sp. gr., in which the silicic acid was digested in the cold during 11 days, dissolved 0.0172 pt. of $Si O_2$. 100 pts. of a solution of carbonate of ammonia, containing 5 pts. of sesquicarbonate of ammonia to 95 pts. of water, dissolved 0.02 pt. of $Si O_2$. 100 pts. of a solution of carbonate of ammonia, containing only 0.1% of the sesquicarbonate, dissolved 0.062 pt. of $Si O_2$. 100 pts. of ammonia-water, containing 19.2% of $N H_3$, dissolved 0.071 pt. of $Si O_2$. 100 pts. of ammonia-water, containing 1.6% of $N H_3$, dissolved 0.0986 pt. of $Si O_2$. (Struckmann, *Ann. Ch. u. Pharm.*, 1855, **94.** 337.)

In criticising Struckmann's paper, Liebig remarks that the solubility of silicic acid in water depends in great measure upon the comparative amount of water in presence of which it is set free by the action of dilute acids, or carbonic acid, on solutions of its alkaline salts. If water is present in sufficient quantity to retain the silicic acid, much more of this will remain in solution than can be dissolved by digesting the gelatinous acid with water. 1 pt. of $Si O_2$ can thus be held in solution in 500 pts. of water. The presence of ammonia, carbonate of ammonia, or chloride of ammonium (in solutions of which silicic acid is remarkably insoluble) diminishes the power of water to retain silica in solution. In all cases the solubility of silicic acid is greater in dilute than in strong solutions of caustic ammonia. (Liebig, *Ann. Ch. u. Pharm.*, 1855, **94.** 373.)

H. Ludwig (from *Arch. der Pharm.*, (2.) **84.** 129; in *Liebig & Kopp's J. B., für* 1855), suggests that the silica examined by Struckmann may not have been pure, but rather a hyperacid silicate of an alkali. According to Ludwig's own experiments, the hydrated silica obtained by precipitating a solution of silicate of potash with chloride of ammonium retains most persistently a certain amount of potash, and also some ammonia; it is soluble in about 10000 pts. of water. Even the precipitate prepared by adding an excess of chlorhydric acid to a solution of silicate of potash retains a portion of potash; this was somewhat soluble in water, even after having been ignited, 1 pt. of it dissolving in about 25000 pts. of water.

Maschke also remarks, that the results of his experiments do not coincide with those of Struckmann. M. operated upon the stiff jelly obtained by passing a current of carbonic acid through a dilute solution of waterglass, this jelly being first washed as thoroughly as possible with distilled water, then stirred about in water which had been acidulated with a few drops of chlorhydric acid, and finally again thrown upon a filter, and again washed with distilled water. As thus obtained, the hydrated silica is tolerably pure, but retains most obstinately traces of chlorhydric acid; after being digested with frequent agitation at the ordinary temperature during three days, it was found that 100 pts. of water had dissolved 0.09 pt. of silicic acid, and that 100 pts. of carbonic acid-water had dissolved 0.078 pt. of silicic acid. But the hydrated silicic acid behaves very differently towards water when heated therewith for a long time in closed vessels upon the water-bath, for in this case complete solution ensues, — even the addition of water is unnecessary, since the jelly itself becomes fluid when thus heated. Such a liquefied jelly contains in 100 pts. 2.49 pts. of silicic acid; it is not precipitated even by very considerable quantities of alcohol, but concentrated saline solutions, as those of carbonate of ammonia, chloride of sodium, and chloride of calcium, cause it to gelatinize. When allowed to evaporate spontaneously, the liquefied jelly at length becomes a thick syrup, and finally solidifies to a mass insoluble in water. (O. Maschke, *J. pr. Ch.*, 1856, **68.** 234.)

Steam having been passed into a large potter's kiln, more than two hundred pounds of silica were dissolved, several pounds of it being subsequently deposited in the form of snow around the openings by which the steam escaped from the kiln, and upon those places which were not heated to redness. (Jeffreys, *Ann. Min.*, 1841, (3.) **19.** 474; compare Dumas, *C. R.*, **13.** 932.) Soluble in aqueous solutions of the caustic alkalies, especially if these are warm, and with still greater ease at the high temperatures produced by heating the liquid under strong pressure in closed vessels.

Soluble in aqueous solutions of the basic alkaline silicates (*liquor silicum*). (Fuchs & Pettenkofer.) Also soluble in aqueous solutions of carbonate of potash and carbonate of soda. Freshly precipitated, unignited silica dissolves even in a cold aqueous solution of potash, with evolution of heat; artificially prepared silica, after strong ignition, also dissolves completely but slowly in a cold solution, and rapidly in a boiling solution of potash. The different kinds of opal behave like precipitated silica; of all the varieties, hyalite dissolves the most slowly in a cold solution of potash. Quartz, even in a state of minute division, is perfectly insoluble in a cold solution, and dissolves only very slowly and with great difficulty in a boiling solution of potash. (Fuchs, *Schw.*, **24.** 378; **67.** 418 [*Gm.*].)

Hydrated silicic acid is very abundantly soluble in a boiling aqueous solution of carbonate of soda separating out again, as a jelly, as the solution cools. (Pfaff, *Schweigger's Journ. für Ch. u. Phys.*, **29.** 383 [T.].) Boiling aqueous solutions of the carbonates of soda and potash dissolve moderately ignited silica or its hydrate in large quantity, depositing it again as a jelly on cooling. (Pfaff, *Schw.*, **29.** 383 [*Gm.*].) Powdered quartz is the least soluble; opal and ignited silica are more readily dissolved, and unignited silica most readily of all. (H. Rose.) If alumina is mixed with the silica it remains undissolved, in combination with a large portion of the silica and some of the alkali. (Forchhammer.) Recently precipitated, and still moist silica is soluble in aqueous solutions of the carbonates of potash and soda, as was first noticed by Pfaff. This solution may occur at a very moderate heat, and is then unattended with any evolution of carbonic acid. It can hardly be believed that an amount of bicarbonate of the alkali is formed proportional to the silica dissolved, since recently precipitated silica is even soluble in the bicarbonates of potash and soda, though very much more difficultly, and, as it would appear, in much smaller quantity than in the normal carbonates. Carbonate of ammonia appears to exert only a very slight solvent action upon recently precipitated silica; but when the latter is digested with caustic ammonia no inconsiderable quantity of it is taken up; this separates again as the ammonia evaporates. (C. J. B. Karsten, *Pogg. Ann.*, 1826, **6.** pp. 356, 357.) Readily soluble in a tolerably concentrated, almost boiling solution of carbonate of potash; the strong solution solidifies to a non-gelatinous mass on cooling, but hot dilute solutions gelatinize on cooling. (Maschke, *J. pr. Ch.*, 1856, **68.** 237.) Pulverulent silica, obtained by evaporating the gelatinous hydrate to dryness upon a water-bath, is soluble in a boiling aqueous solution of carbonate of soda. (Berzelius, *Pogg. Ann.*, 1829, **16.** 388.) From a concentrated solution in a boiling solution of alkaline carbonate much of the silica separates as a jelly on cooling, but if the hot solution is diluted with boiling water, the silica will remain dissolved, even when the solution has become cold, a small portion only separating after a time, if the carbonated alkali was completely saturated with it. In this dilute solution the alkali may be saturated with an acid without precipitating any of the silica, this having been dissolved by the water rather than by the alkali. (Berzelius, *Lehrb.*, **1.** 668.) On the addition of chloride of ammonium, or other ammonia-salt, to the solution in carbonate of soda silica is precipitated, — a good test for the presence of the latter being thus afforded. (A. Mueller, *J. pr. Ch.*, 1860, **80.** 118.) When in the gelatinous condition, silica is "very sensibly soluble" in butylamin. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **42.** 166.) Gelatinous silicic acid is very slowly and sparingly dissolved by sulphuric, nitric, and chlorhydric acids. These acids dissolve the largest quantity when a compound of silica with a fixed alkali, in which the latter predominates, is mixed with an excess of the acid in a state of great dilution, — so that the silica, at the moment of its separation from the alkali, meets with a sufficient quantity of acid and water to dissolve it. From these solutions, ammonia, carbonate of ammonia, potash, and soda precipitate a portion of the silicic acid. Carbonate of lime also precipitates it, best when the solution is warm, and not too dilute. When a solution of silica in any volatile acid, excepting fluorhydric acid, is evaporated to perfect dryness, the $Si\,O_2$ left as a residue is insoluble, either in water or acids. Readily soluble in an aqueous solution of fluorhydric acid. Neither amorphous nor crystalline silicic acid is at all soluble in an aqueous solution of cane-sugar. (Petzholdt.) All the metallic salts of silicic acid are insoluble in water, excepting some of those of potash, soda, and lithia.

Silicate of Alumina.

I.) *mono.*

a = anhydrous. Occurs as the minerals *Andalusite, Cyanite,* and *Sillimanite.* It is scarcely, or not at all, acted upon by acids.

b = hydrated. Occurs as the mineral *Allophane,* which is decomposed by concentrated acids, the alumina being dissolved and the silica separated in the gelatinous condition. It dissolves completely in dilute acids.

$Al_2\,O_3,\ Si\,O_2 + 5\,Aq$ or $6\,Aq$

II.) *bi.* As they occur in nature, the kaolins or clays very frequently contain, besides other impurities, an excess of silica. Clays do not dissolve in dilute chlorhydric or nitric acid. (Forchhammer.) They are attacked by strong acids, but, as a rule, the alumina only, and not the silica, is dissolved. Hot sulphuric acid decomposed many of them almost completely, with separation of silica. When carefully heated until the whole of its water is expelled, clay still remains soluble in sulphuric acid and potash; by ignition, however, its solubility is destroyed. [*Gm.*, **3.** 415.] When plastic clay is calcined at a dull red heat, too high a temperature being avoided, it is rendered much more soluble in acids than it was in its crude, hydrated condition. (Compare

(*Kaolin.*)
$Al_2\,O_3,\ 2\,Si\,O_2 + 2\,Aq$

Ordway, *Am. J. Sci.*, 1858, (2.) **26.** 203, *note.*) By boiling clay with a solution of potash, a double silicate of alumina and potash is formed, which is dissolved more perfectly in proportion to the excess of potash employed. [*Gm.*, **3.** 415.] According to Brongniart and Malaguti, boiling potash-lye abstracts a certain amount of silica (¼ of the whole) from many varieties of kaolin, and according to Bauer, potash-lye is capable of abstracting ⅓ of the silicic acid from ignited kaolin of Zettlitz; but according to Rammelsberg (*Mineralchemie*, pp. 572, 575), and Stephan, bisilicate of alumina ($Al_2 O_3, 2 Si O_2 + 2 Aq$) is dissolved out as such, when kaolin is repeatedly boiled with potash-lye, almost pure silica being left behind.

The mineral *Halloysite* contains more water than *kaolin*, being of composition $Al_2 O_3, 2 Si O_2 + 4 Aq$. It is easily decomposed by concentrated acids.

III.) *di.* $2 Al_2 O_3, Si O_2 + 9 Aq$ Occurs as the mineral *Collyrite*, which is decomposed by acids, the solution yielding a jelly on evaporation.

IV.) *sesqui.* $2 Al_2 O_3, 3 Si O_2 + 4 Aq$ Occurs as the mineral *Pholerite*, which is insoluble in nitric acid. (Guillemin.)

Besides these silicates of alumina there are various other ill-defined basic compounds.

V.) $2 Al_2 O_3, 9 Si O_2 + 4 Aq$ Occurs as the mineral *Pyrophillite.* Partially soluble in sulphuric acid.

Silicate of Alumina & of Baryta.

I.) $(3 Ba O, Si O_2) ; 4 (Al_2 O_3, 2 Si O_2) + 12 Aq$ Occurs as the mineral *Edingtonite.* Decomposed by acids, with separation of gelatinous silica.

II.) $2 Ba O, 3 Si O_2 ; 2 (Al_2 O_3, 3 Si O_2) + 10 Aq$ Occurs as the mineral *Harmotome.* When finely powdered, it is completely, though difficultly decomposed by hot chlorhydric acid, silica being separated in the pulverulent state.

Silicate of Alumina & of Glucina.

I.) $Al_2 O_3, 3 Si O_2 ; Gl_2 O_3. 3 Si O_2$ Occurs in nature as *Beryl*, *Emerald*, &c. It is not decomposed by acids, or only partially by sulphuric acid after strong ignition.

II.) (*Euclase.*) Unacted upon by acids.
$3 Al_2 O_3, 2 Gl_2 O_3, 6 Si O_2 + 3 Aq$

Silicate of Alumina & of Lime.

I.) $Ca O, Si O_2 ; Al_2 O_3, Si O_2$ Occurs as the mineral *Anorthite.* Completely decomposed by concentrated chlorhydric acid, with separation of pulverulent silica.

II.) $2 (Ca O, Si O_2) ; Al_2 O_3, Si O_2 + Aq$ Occurs as the mineral *Prehnite.* Only imperfectly acted upon by acids; but after strong ignition or fusion, acids decompose it completely, forming a jelly. (v. Kobell.)

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5.** 403.)

III. *a.*) $Ca O, Si O_2 ; Al_2 O_3, 2 Si O_2$ Occurs as the mineral *Ersbyite* (*Lime-labradorite*).

III. *b.*) $Ca O, Si O_2 ; Al_2 O_3, 2 Si O_2 + 3 Aq$ Occurs as the mineral *Scolecite* (*Lime-mesotype*). Readily decomposed by chlorhydric acid, but without separation of gelatinous silica. Partially soluble in oxalic acid, with separation of oxalate of lime.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5.** 403.)

III. *c.*) $Ca O, Si O_2 ; Al_2 O_3, 2 Si O_2 + 4 Aq$ Occurs as the mineral *Levyne.* When pulverized, it is decomposed by acids, without gelatinizing.

IV. *a.*) $Ca O, 2 Si O_2 ; Al_2 O_3, 2 Si O_2 + 3 Aq$ Occurs as the mineral *Caporcianite.* Easily soluble in acids, with separation of gelatinous silica.

IV. *b.*) $Ca O, 2 Si O_2 ; Al_2 O_3, 2 Si O_2 + 4 Aq$ Occurs as the mineral *Laumonite.* Easily soluble in chlorhydric acid, with separation of a siliceous jelly. It gelatinizes also with nitric acid, but is not affected by sulphuric acid unless this is hot.

IV. *c.*) $Ca O, 2 Si O_2 ; Al_2 O_3, 2 Si O_2 + 6 Aq$ Occurs as the mineral *Chabazite.* When powdered, it may be completely decomposed by chlorhydric acid, though this is only accomplished with difficulty.

V. *a.*) $Ca O, 2 Si O_2 ; Al_2 O_3, 4 Si O_2 + 5 Aq$ Occurs as the mineral *Heulandite.* Readily decomposed by chlorhydric acid, with separation of viscid silica.

V. *b.*) $Ca O, 2 Si O_2 ; Al_2 O_3, 4 Si O_2 + 6 Aq$ Occurs as the mineral *Stilbite* (*Desmine*). Slowly but completely decomposed by concentrated chlorhydric acid, with separation of viscid silica.

VI.) $2 (Ca O, Si O_2) ; 2 Al_2 O_3, 3 Si O_2$ Occurs as the mineral *Barsowite*, which gelatinizes easily when heated with chlorhydric acid.

VII.) $3 (2 Ca O, Si O_2) ; 2 (2 Al_2 O_3, 3 Si O_2)$ Occurs as the mineral *Meionite.* Completely decomposed by chlorhydric acid, with separation of gelatinous silica.

Silicate of Alumina, of Lime & of Potash.

I.) $K O, Si O_2 ; 2 (Ca O, Si O_2) ; 3 (Al_2 O_3, 3 Si O_2) + 15 Aq$ Occurs as the mineral *Phillipsite* (*Lime-harmotome*). Easily and completely decomposed by chlorhydric acid, with separation of gelatinous silica.

II.) $Ca O, K O, Si O_2 ; Al_2 O_3, Si O_2 + 4 Aq$ Occurs as the mineral *Gismondine.* Readily and completely soluble in chlorhydric acid, the solution yielding a siliceous jelly on being evaporated.

Silicate of Alumina, of Lime & of Soda.

I.) $Ca O, Si O_2 ; Na O, Si O_2 ; Al_2 O_3, 2 Si O_2 + 6 Aq$ Occurs as the mineral *Gmelinite* (*Soda-chabazite*). Completely decomposed by chlorhydric acid, with separation of gelatinous silica.

II.) $Ca O, Si O_2 ; Na O, Si O_2 ; 2 Al_2 O_3, 7 Si O_2 + 18 Aq$ Occurs as the mineral *Faujasite.* Soluble in chlorhydric acid.

Silicate of Alumina & of Potash.

I.) $K O, 2 Si O_2 ; Al_2 O_3, 2 Si O_2$ Occurs as the mineral *Leucite.* The powdered mineral is completely decomposed by acids, with separation of pulverulent silica.

Decomposed and dissolved to a certain extent by carbonic acid-water and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5**. 403.)

II.) $KO, 3SiO_2; Al_2O_3, 3SiO_2$ Occurs as the mineral *Orthoclase* (*Feldspar*), which is not acted upon to any great extent by acids. Powdered feldspar dissolves with difficulty and only partially in hot chlorhydric acid. (G. Rose.) When finely powdered feldspar is exposed to a prolonged digestion in sulphuric or chlorhydric acid a portion of the mineral is dissolved, even at the ordinary temperature; 30 grains of potash feldspar being digested during 12 hours in chlorhydric acid, at 15.56°, lost nearly a grain in weight, the solution containing both chloride of potassium and chloride of aluminum. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **6**. 396.) It is decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5**. pp. 403, 404.) If powdered feldspar is ignited and then boiled with milk of lime it gives up potash to the water, the lime taking the place of potash in the compound. (Fuchs, Zierl.) When in a state of minute division, feldspar is not sensibly acted upon by water at a temperature of 100°; at 125°, in a Papin's digester, it renders the water feebly alkaline; at 150° strongl, and at 220° still more strongly alkaline. (Forchammer, *Pogg. Ann.*, **35**. 353 [*Gm.*].)

Silicate of Alumina & of Soda.

I.) $NaO, SiO_2; Al_2O_3, 2SiO_2 + 2Aq$ Occurs as the mineral *Natrolite* (*Soda-mesotype*). Readily soluble even after ignition, in chlorhydric acid, with separation of gelatinous silica.

Easily soluble in oxalic acid. (Fuchs.) Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5**. 403.)

II.) $NaO, 2SiO_2; Al_2O_3, 2SiO_2 + 2Aq$ Occurs as the mineral *Analcime*. Readily decomposed by chlorhydric acid, with separation of gelatinous silica. After the mineral has been ignited, however, the decomposition becomes more difficult.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5**. 403.)

III.) $NaO, 3SiO_2; Al_2O_3, 3SiO_2$ Occurs as the mineral *Albite* (*soda-feldspar*), which is not decomposed by alkaline solutions or by acids, but is acted upon to a certain extent by hot acids.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5**. pp. 403, 404.)

Silicate of Amyl.

I.) *di.* Insoluble in water, by which it is very slowly decomposed. Soluble in all proportions in alcohol, ether, and hydrate of amyl (fusel-oil). (Ebelmen, *Ann. Ch. et Phys.*, (3.) **16**. 155.)

("*Protosilicate*" [$C_{10}H_{11}O, SiO$] of Ebelmen.)
$2C_{10}H_{11}O, SiO_2$

Silicate of Baryta. One part of silica fused with 2 pts. or more of baryta yields a compound soluble in acids. (Kirwan; Vauquelin.)

As prepared in the wet way, by adding an aqueous solution of baryta to a solution of waterglass, it is readily soluble in an excess of a solution of waterglass. (Bolley.)

Silicate of Cerium. Occurs as the mineral $2CeO, SiO_2 + Aq$ *Cerite*. When finely powdered it dissolves easily in chlorhydric acid, with separation of gelatinous silica. After having been ignited it is more easily soluble in acids than before.

Silicate of Copper.

$a = CuO, SiO_2 + Aq$ Occurs as the mineral *Dioptase*. Soluble in hot nitric and chlorhydric acids, with separation of gelatinous silica.

Unacted upon by a solution of caustic potash, but dissolves, with separation of silica, in solutions of caustic or carbonated ammonia. (Damour.)

$b = CuO, SiO_2 + 2Aq$ Occurs as the mineral *Chrysocolla*. Decomposed by chlorhydric and other acids, with separation of gelatinous silica.

Silicate of Ethyl.

I.) *mono.* Permanent. Insoluble in water, and only very slowly decomposed by contact therewith. Soluble in all proportions in alcohol, and ether; also soluble in the other silicates of ethyl. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **16**. pp. 150, 153.)

("*Bisilicate*" [$C_4H_5O, 2SiO$], of Ebelmen.)
C_4H_5O, SiO_2

II.) *bi.* Soluble in alcohol, and ether, and in monosilicate and disilicate of ethyl. (Ebelmen.)

("*Quadrisilicate*" [$C_4H_5O, 4SiO$] of Ebelmen.)
$C_4H_5O, 2SiO_2$

III.) *di.* Insoluble in water, but is slowly decomposed thereby. Soluble in all proportions in alcohol, and ether. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **16**. 145.)

("*Protosilicate*" [C_4H_5O, SiO] of Ebelmen.)
$2C_4H_5O, SiO_2$

Silicate of Glucina.

I.) *basic.* Occurs as the mineral *Phenacite*.
$2Gl_2O_3, 3SiO_2$

Silicate *of protoxide* **of Iron.**

I.) *normal.*
FeO, SiO_2

II.) *basic.* $2FeO, SiO_2$ Chlorhydric acid extracts the oxid of iron, and leaves the silica undissolved. (Mitscherlich, and others.) Occurs native as *Fayalite*, a mineral easily attacked by acids. (Delesse.)

Silicate *of sesquioxide* **of Iron.**

I.) $Fe_2O_3, 3SiO_2 + 3Aq$ Occurs as the mineral *Chloropal*. Insoluble in cold acids, but soluble in hot sulphuric, chlorhydric, and nitric acids, with separation of gelatinous silica. (Berthier.)

II.) $2Fe_2O_3, 9SiO_2 + 2Aq$ Occurs as the mineral *Anthosiderite*. Acids decompose it.

Silicate of Iron & of Magnesia.

I.) $FeO, SiO_2; 3(MgO, SiO_2)$ Occurs as a variety of the mineral *Anthrophyllite*. Scarcely at all acted upon by acids.

II.) $FeO, SiO_2; 6(MgO, SiO_2)$ Occurs as a variety of the mineral *Anthrophyllite*. Scarcely at all acted upon by acids.

III.)

$a = 2FeO, SiO_2; 2(2MgO, SiO_2)$ Occurs in nature as

Hyalosiderite, which is difficultly soluble in cold concentrated chlorhydric acid, the solution yielding a jelly on being evaporated. (Walchner.)

b = *various compounds.* Varieties of the mineral
$2\,FeO, SiO_2; 4 @ 7 (2\,MgO, SiO_2)$.
$2\,FeO, SiO_2; 13 (2\,MgO, SiO_2)$.
Olivine. See under SILICATE OF MAGNESIA.

SILICATE OF IRON & OF MANGANESE.

I.) *basic.* MnO, FeO, SiO_2 Occurs native as *Knebelite*, which is decomposed by chlorhydric acid, with partial solution and separation of gelatinous silica. (Dœbereiner.)

SILICATE OF LIME.

I.) *normal.* CaO, SiO_2 Insoluble in water. The native mineral (*Tabular-spar*, *Wollastonite*) is decomposed and partially dissolved by chlorhydric acid, gelatinous silica separating out.

II.) *bi.* $CaO, 2\,SiO_2 + 2\,Aq$ Occurs as the mineral *Okenite.* When powdered, this is easily decomposed by cold chlorhydric acid, with separation of gelatinous flakes of silica; but after ignition it cannot be thus dissolved. (v. Kobell.)

Recently precipitated silicic acid being added to lime-water removes all the lime from the solution, excepting a small quantity which remains in combination with the silica, the compound thus formed not being completely insoluble in water. (Gadolin, *Ann. de Chim.*, 1797, **27.** 320.) As prepared in the wet way, by adding lime-water to a dilute solution of waterglass, silicate of lime is readily soluble in an excess of the waterglass solution. (Bolley.)

SILICATE OF LIME & OF MAGNESIA.

I.) $CaO, SiO_2; 2 (MgO, SiO_2)$ Occurs as the mineral *Diopside.* Only very slightly acted upon by acids.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5.** 403.)

II.) $CaO, SiO_2; 3 (MgO, SiO_2)$ Occurs as the mineral *Tremolite*, which is not acted upon by acids.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5.** pp. 403, 404.)

SILICATE OF LIME & OF POTASH. $KO, 2\,SiO_2; 8 (CaO, 2\,SiO_2) + 18\,Aq$ Occurs as the mineral *Apophyllite.* The powdered mineral is easily decomposed by chlorhydric acid, with separation of silica; but after ignition it is with difficulty acted upon by chlorhydric acid.

When apophyllite is heated with water to 180° @ 190°, under a pressure of 10 @ 12 atmospheres, it dissolves, and crystallizes again as the solution cools (Wœhler); but at the ordinary temperature, even under a pressure of 12 @ 79 atmospheres, no trace of it is dissolved. (Bunsen.)

SILICATE OF LIME & OF SODA. $NaO, 4\,CaO, 6\,SiO_2 + Aq$ Occurs as the mineral *Pectolite.* This is very slowly acted upon by chlorhydric acid, unless it be in powder. If the mineral is ignited before being treated with chlorhydric acid, the latter causes the silica to separate in the gelatinous condition. (v. Kobell.)

SILICATE OF LIME with TITANATE OF LIME.

$CaO, 2\,SiO_2; CaO, 2\,TiO_2$ Occurs as the mineral *Sphene* (*Titanite*). When finely powdered, it is partially decomposed by chlorhydric, and more completely by sulphuric acid. Fluorhydric acid decomposes it more easily.

SILICATE OF MAGNESIA.

I. *a.*) MgO, SiO_2 Insoluble in chlorhydric acid or a solution of caustic potash. (Ebelmen, *loc. inf. cit.*) It occurs also in nature as the mineral *Enstatite.* Unacted upon by acids. (Kenngott.)

As prepared in the wet way, by adding an aqueous solution of magnesia to a dilute solution of waterglass, silicate of magnesia is readily soluble in an excess of a solution of waterglass. (Bolley.)

b = $2 (MgO, SiO_2) + Aq$ Occurs as the mineral *Picrosmine.*

c = $2 (MgO, SiO_2) + 3\,Aq$ Occurs as the mineral *Kerolite.* It is unacted upon by acids.

d = $4 (MgO, SiO_2) + 3\,Aq$ Occurs as the mineral *Aphrodite.* Decomposed by concentrated acids, with separation of gelatinous silica.

II.) $2\,MgO, SiO_2$ Insoluble in water, or cold dilute chlorhydric acid. Decomposed by hot concentrated chlorhydric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **33.** 57.) It occurs also in nature, mixed with disilicate of iron, as the mineral *Chrysolite* (*Olivine*) of composition $2\,FeO, SiO_2; 32 @ 40 (2\,MgO, SiO_2)$. Chrysolite is not decomposed by chlorhydric acid, but is decomposed by sulphuric acid, with separation of pulverulent silica. (v. Kobell, *J. pr. Ch.*, **5.** 214 [*Gm.*].) Olivin is decomposed with the greatest facility by chlorhydric acid, with separation of gelatinous silica. (Berzelius, in his *Jahresbericht*, 1836, **15.** 217.) Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, **5.** 403.)

III.) $2\,MgO, 3\,SiO_2 + 2\,Aq$ & $4\,Aq$ Occurs as the mineral *Meerschaum.* Decomposed by chlorhydric acid, with separation of silica.

IV.) $5\,MgO, 6\,SiO_2 + 4\,Aq$ Occurs as the mineral *Spadaite.* Easily decomposed by chlorhydric acid, with separation of gelatinous silica. (v. Kobell.)

V.) $12\,MgO, 15\,SiO_2 + 4\,Aq$ Occurs as the mineral *Talc* and *Steatite.* It is not acted upon by acids.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, **5.** 403.)

VI.) $3\,MgO, 2\,SiO_2 + 2\,Aq$ Occurs as the mineral *Serpentine.* Powdered serpentine dissolves in concentrated chlorhydric acid, leaving a siliceous jelly; it is still more easily acted upon by sulphuric acid.

Decomposed and dissolved to a certain extent by carbonic acid-water, and also even by pure water. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, **5.** 403.)

VII.) $4\,MgO, 3\,SiO_2 + 6\,Aq$ Occurs as the mineral *Deweylite* (*Gymnite.*)

SILICATE OF MANGANESE.

I.) *normal.* $Mn O, Si O_2$ Occurs native as *Manganese Spar*, or *Rhodonite.* This is partially soluble in concentrated chlorhydric acid, being completely decomposed thereby.

II.) *basic.* $2 Mn O, Si O_2$ Occurs as the mineral *Tephroite*, which forms a stiff jelly with chlorhydric acid, being completely decomposed. (Rammelsberg.)

Silicate *of dinoxide* **of Mercury.**

Silicate of Molybdenum.

Silicate of Potash.

I.) *mono.* $K O, Si O_2$ Deliquescent. Soluble in cold water. (H. Rose.)

II.) *basic.* 1 @ 2 (or more) $K O, Si O_2$ Deliquescent. Readily soluble in cold water, forming the *liquor silicum*, or *Kieselfeuchtigkeit*, of the earlier chemists. Also soluble in aqueous alkaline solutions.

On adding to *liquor silicum* an acid in quantity not sufficient for saturation, there is precipitated a compound of the potash with excess of silica; but a larger quantity of acid throws down the silica as a gelatinous hydrate. (Dalton.) For further details of the behavior of the aqueous solution with acids, see under Silicic Acid. If acetate of soda be added to a solution of silicate of potash, with or without an excess of base, silicic acid will be precipitated. Several other soda salts may be substituted for the acetate in this experiment. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 445; compare Ordway's statements, under Silicate of Soda.)

III.) *acid.*

a = $K O, 2\frac{1}{2}$ @ $4\frac{1}{2}\ Si O_2$ (*Waterglass. Soluble glass.*) Permanent. Fused waterglass is slowly, but almost completely soluble in boiling water. (Fuchs.) More readily soluble in water than the corresponding soda-salt, the potash silicates being more soluble than the corresponding soda compounds. (Ordway, *Am. J. Sci.*, (2.) **32.** 155.) Potash silicates, which are rather alkaline, are more deliquescent than the corresponding soda silicates. (Ordway.) Waterglass is much less readily soluble when contaminated with earthy impurities than when pure. Fuchs says that an insoluble glass cannot be prepared from pure quartz and pure potash. "For if we take two pts. of quartz to one of potash we obtain, as I have convinced myself, a glass which partly dissolves in water." These proportions would make about $K O, 5\ Si O_2$. (*Ibid.*, p. 162.)

When an aqueous solution of waterglass is evaporated to dryness, there is obtained a permanent, hydrated mass which dissolves very slowly in cold water, but readily in boiling water. (Fuchs, [*Gm.*].) A concentrated aqueous solution containing 28% of anhydrous $K O, 4\ Si O_2$ is of 1.25 sp. gr. (Fuchs.)

Alcohol, even in small quantity, precipitates waterglass from its aqueous solution, and thus affords a means of purifying it from other salts of potash, which are soluble in spirit. (Fuchs, *Kastner's Archiv.*, **5.** 385. [*Gm.*].) The alcohol, however, withdraws potash, even in the precipitation of the salt, and still more on washing, until octosilicate of potash alone remains. (Forchhammer.)

Alcohol, and wood-spirit, precipitates silicate of potash, as such, from its aqueous solution, even when this is very dilute. Contrary to the view formerly held by Fuchs, the alcohol, in this experiment, always effects a partial decomposition of the silicate, the precipitate thrown down being somewhat more siliceous than the original silicate. [Compare Silicate of Soda.] (Ordway, *Am. J. Sci.*, (2.) **33.** pp. 27, 29.) Silicate of potash is thrown down somewhat less readily and completely than silicate of soda. The precipitates thus obtained by alcohol are for the most part readily soluble in cold water. (*Ibid.*, **32.** pp. 340, 341.)

In determining what is the highest possible relative proportion of silica capable of entering into complete solution it is very important to eliminate the last traces of foreign matters and to operate only upon pure products. Fuchs could not get much beyond $K O, 3\frac{3}{4}\ Si O_2$, and even this solution he describes as being usually lacking in clearness; and Forchhammer (*Pogg. Ann.*, **35.** 341), says that while silicate of potash, in which the oxygen of the acid is eight times as great as that of the base is still soluble, the slightest additional quantity of silica is no longer dissolved. Both these observers evidently overlooked the disturbing influence of minute portions of earthy matter. For in reality, by operating with a well-purified silicate, prepared by precipitation with alcohol, as above mentioned, it is possible to get at, least as far as $K O, 4\frac{1}{2}\ Si O_2$, or $Na O, 4\frac{1}{2}\ Si O_2$, and have a solution perfectly transparent. (Ordway, *Am. J. Sci.*, (2.) **33.** 33.)

For the precipitation of waterglass by salts of potash and soda, and for numerous other points concerning it, see under Silicate of Soda.

b = *hyperacid.* A hydrated octosilicate ($K O, 8\ Si O_2 + x\ Aq$) obtained by Forchhammer, by precipitating an aqueous solution of waterglass with an excess of alcohol, and washing the precipitate with spirit of 30%, so long as the filtrate exhibited an alkaline reaction, was only partially soluble in hot water. The insoluble residue obtained by thoroughly boiling the octosilicate in water contained $K O, 18\ Si O_2 + 9\ Aq$. $K O, 24\ Si O_2$ is a gelatinous precipitate insoluble in water. (Forchhammer.)

Silicate of Potash & of Strontia. Insoluble in water.

Silicate of Potash & of Zinc. Soluble in an aqueous solution of caustic potash, and in acids, with separation of gelatinous $Si O_2$.

Silicate of Potash with **Titanate of Potash.** Insoluble in water. While still moist it is readily soluble in concentrated chlorhydric acid. (H. Rose.)

Silicate of Soda.

I.) *mono.* $Na O, Si O_2 + 6, 7, 8,$ or $9\ Aq$ Permanent. Very soluble in water. Melts in its water of crystallization. (Fritzsche; Hermann.)

II.) *basic.* (*Liquor silicum.*) See the corresponding potash compound.

III.) *acid.*

a = *Waterglass.* $Na O, 2$ @ $3\frac{3}{4}$ (or more) $Si O_2$ Permanent. Slowly but completely soluble in boiling water. (Fuchs.) Fused waterglass is but little acted on by cold water, but when pure it dissolves without much difficulty in water kept continually boiling; though the solution goes on slowly and so evenly that bits retain to the last their exact original form, the sharp angles even not being rounded. (Ordway, *Am. J. Sci.*, (2.) **32.** 337.) For making a liquid or pasty silicate, the glass coarsely ground may be boiled with water till the solution stands at about 25° B. after cooling. If it is made much stronger than this it will not settle readily. Some manufacturers dissolve waterglass by blowing steam directly into the water, but in that case the solution goes on very slowly, because the heat is insufficient. It is far better to have an iron kettle heated by a fire. After the solution has been allowed to deposit suspended insoluble matters, it may be concentrated by evaporation to any required degree, within certain limits. When it becomes thick, the further application of heat is attended with no little difficulty; for the silicate then rapidly adheres to the kettle, and there is needed very diligent scraping with a chisel-pointed bar to keep the bottom and sides of the vessel clear of the spongy coating; and to push the evaporation to dryness is quite out of the question. A solution of the silicate $\mathrm{Na\,O}, 2\frac{1}{4}\,\mathrm{Si\,O_2}$ cannot conveniently be made stronger than 50° B. (Ordway, *Am. J. Sci.*, (2.) **32.** 162.)

In operating in the large way, where solutions are wanted day after day, it saves much time and fuel not to try to dissolve completely any given quantity of the glass in a particular amount of water, but always to keep an excess of the coarsely ground silicate in the kettle, and boil, with frequent stirring, till the liquor acquires a sufficient strength, as shown by the hydrometer. If the solution is dipped out hot, either the kettle must be immediately filled again with hot water, or the glass also must be taken out and held back till the water becomes hot, otherwise the silicate is apt to stick together and adhere most obstinately to the bottom of the kettle.

When a waterglass contains a greater portion of silica than is needed to constitute a tersilicate ($\mathrm{Na\,O}, 3\,\mathrm{Si\,O_2}$) its solution is the work of many hours. As the relative amount of silica is increased, the precise point at which the product ceases to be integrally soluble has never yet been ascertained. (Ordway, *Am. J. Sci.*, (2.) **32.** 337.)

When boiled with a large excess of water, fused waterglass tends to undergo decomposition, a small portion of it being left undissolved; the amount of this insoluble matter depending in great measure upon the quantity of water used. In other words, very siliceous waterglass is not integrally soluble in mere water, but dissolves without any considerable decomposition in a strong solution of the silicate itself. When the least practicable proportion of water is taken, the light flocculent deposits actually obtained are made up chiefly of earthy and metallic silicates; and it may be fairly inferred that in such cases an absolutely pure silicate of potash or soda would give no remainder except the very little produced by the first contact of pure water with the outer surface. But the sediment left after the action of a large quantity of water is dense and scaly, and under the microscope appears to consist of purely siliceous filmy skeletons of the original particles of the glass; and there would doubtless be such a residue even though the silicate were completely free from foreign matter. The greater the proportion of alkali, the less decomposable is fused waterglass; and it may safely be said that pure products, a little more alkaline than $\mathrm{Na\,O}, 2\frac{1}{4}\,\mathrm{Si\,O_2}$, would dissolve without remainder in any quantity of water, however great. (Ordway, *Am. J. Sci.*, (2.) **35.** pp. 193 – 195; for the *quantitative results* obtained by Ordway in this connection we must refer the reader to the original memoir.)

The aqueous solution of waterglass must not be confounded with the much more alkaline *liquor silicum* (*Kieselfeuchtigkeit*, of the Germans) obtained by dissolving basic, *deliquescent*, silicate of soda. It is true, that, strictly speaking, no actual line of demarcation can be drawn between these substances, yet they really constitute two distinct bodies, at least in so far as difference of properties is concerned. Any silicate of soda more alkaline than $\mathrm{Na\,O}, 2\frac{1}{4}\,\mathrm{Si\,O_2}$ is prone to deliquescence, and is too poor in silica for most uses to which waterglass is applied, and it would perhaps be but just to consider "waterglass" as including nothing more basic than this. (Ordway, *Am. J. Sci.*, (2.) **32.** 156.) $\mathrm{Na\,O}, 1\frac{1}{2}\,\mathrm{Si\,O_2}$ is readily taken up by water at less than the boiling heat. (Ordway, *loc. cit.*, **32.** 338.)

Silicate of soda is somewhat harder to dissolve in water than a corresponding silicate of potash. (Ordway, *Am. J. Sci.*, (2.) **32.** pp. 338, 155.) Waterglass which contains both potash and soda forms a thinner solution than either of these silicates taken separately. (Dœbereiner.)

A simple (fused) soda or potash silicate with $4\frac{1}{2}$ or more equivalents of acid to one of base may be considered as practically insoluble in water, though of course such glass would be, like ordinary window-glass, etc., somewhat acted upon by boiling water. Peligot found the so-called "alabaster glass" of commerce to consist almost entirely of silica and potash in such proportions as to make $\mathrm{K\,O}, 7\frac{1}{2}\,\mathrm{Si\,O_2}$, were the silica all in combination; but in this case a part of the silica is merely diffused, and so produces the opacity of the glass. (Ordway, *Am. J. Sci.*, (2.) **32.** 163.) For Fuchs's view, that no insoluble glass can be prepared from pure silica and pure potash, see below, among the remarks upon ordinary glass.

The solubility of waterglass is much impaired by the presence of earthy impurities; hence, when it is desired to obtain the greatest possible relative amount of silica in solution, it is necessary to make the glass of none but the purest materials. Earthy or metallic oxides very much lessen the solubility of the product, and if more than a mere trace of them is present, a larger proportion of alkali is required to render the mass capable of yielding readily to boiling water. A silicate so contaminated will not in fact enter directly into solution; it is only decomposed by boiling with water, into a more alkaline silicate which dissolves, and a compound earthy silicate which remains as a bulky residue, often in the form of plates or scales. Thus, of a well-worked waterglass made from crude sulphate of soda, water took up only 89%, leaving a copious sediment consisting of soda, lime, magnesia, alumina, ferrous and ferric oxides, and silica. Indeed, common glass is but an alkaline silicate, rendered insoluble by a more considerable amount of lime or oxide of lead. Sand which contains clay, mica, feldspar, lime, or oxide of iron is unsuitable for the manufacture of waterglass. When waterglass thus contaminated is treated with boiling water, the earths and metallic oxides are mostly left behind as compound silicates; and if sulphides are present, a part of the iron remains, as sulphide, giving a blackish color to the sediment. But these foreign matters are not left wholly undissolved, for a solution of waterglass has the power of taking up small quantities of most oxides, and the solvent power increases with the strength of the solution; so that a liquor which is slightly turbid while weak, may become quite clear by concentration, and, on the other hand, this clear, strong liquid is rendered turbid again by large dilution. (Compare Silicate of Potash.) (Ordway, *Am. J. Sci.*, (2.) **32.** pp. 162, 338.)

On the addition of alcohol or wood-spirit to an aqueous solution of waterglass the greater part of the silicate is precipitated as such, even when the solution is very weak. This precipitation is, however, attended with a certain amount of decomposition, the alcohol tending to retain in solution a portion of a silicate more alkaline than that previously dissolved in the water, while the precipitate formed is always somewhat more siliceous than the original silicate. The more any given waterglass solution is diluted before adding alcohol, the greater will be the relative amount of silica in the precipitate. Hence by mere precipitation under varied conditions, an unlimited number of differently constituted silicates may be obtained. But while the ratio of acid and base admits of an infinite diversity, the quantity of water in the principal products appears to be nearly constant, generally amounting to not far from fifty per cent. The quantity of silicate which remains dissolved in the supernatant alcoholic liquid is always exceedingly small, but is somewhat increased by heat. A mother liquor of this sort, which is quite milky when first decanted, becomes perfectly transparent by being warmed a few degrees, and the opacity reappears on cooling. Indeed, a nicely balanced solution of this kind is quite sensitive to changes of temperature in the room; and the nearer we get to an entire precipitation of the silica, the more apt is the remaining liquid to exhibit such alternations of opacity and clearness. The silicates, containing less than $2\frac{1}{2}$ equivalents of $Si\,O_2$ to 1 equivalent of alkali, are usually thrown down in the liquid state; those more siliceous yield solids of greater and greater firmness as the relative proportion of silica increases. In most cases these precipitates dissolve readily in cold water. Silicate of soda is thrown down by alcohol somewhat more readily and completely than silicate of potash.

When a waterglass is contaminated with saline and earthy impurities, these may be got rid of by several properly conducted fractional precipitations with alcohol, — the salts remaining dissolved in the alcoholic liquors while the earthy and metallic oxides are withdrawn by the first small fractional deposits. Since solutions containing even as much as ten per cent of any of the salts commonly occurring in crude waterglass are not immediately affected by a moderate addition of alcohol, it is not strange that the greater part of these salts should remain in the supernatant liquor while the waterglass is almost wholly precipitated. (Ordway, *Am. J. Sci.*, (2.) **32.** 340; **33.** pp. 35, 27. For the numerous *quantitative results* obtained by Ordway in his experiments upon the precipitation of waterglass by alcohol, see *Am. J. Sci.*, (2) **33.** pp. 27 – 33.)

Many neutral potassium and sodium salts precipitate waterglass, as such, when added to its aqueous solution, the salt used as a precipitant not entering into the chemical composition of the deposit, which consists of silica, alkali, and water united in no definite proportions. Like alcohol, these saline solutions exert a slight parting force on the constituents of waterglass, the precipitate being always more siliceous than the original silicate; and the more siliceous, moreover, in proportion as the solutions employed are more dilute before being mixed. The less alkaline the silicate is, the more matter is thrown down by a given saline liquid; and the more concentrated the solutions are, the more complete is the precipitation. With strong liquors, an increase in the quantity of the precipitant used is not attended by a proportionate increase in the amount of coagulum; but a little more of the saline liquid than will just produce a disturbance usually suffices to throw down the greater part of all that is precipitable. The precipitates have a greater or less tendency to cohere into hard or pasty masses, which can be in great measure freed from adhering mother liquor by strong pressure. After having thus been forcibly cleared of foreign matter, all the precipitates, which are less siliceous than $R\,O,\ 4\frac{1}{2}\ Si\,O_2$, are wholly soluble in cold water; when exposed to the air for a day or two in a warm place, they lose 20% or more of their weight, and become dry and hard, — their solubility remaining unimpaired. Silicate of soda yields a larger deposit than silicate of potash does under similar conditions. When a silicate of one alkali is precipitated by a salt of the other, both bases enter into the composition of the solid product, and the relative proportion of potash and soda therein is very nearly the same as in the average of the liquors mixed.

Different salts possess very unequal precipitating power, the acetates and chlorides being particularly efficient. Heat increases the precipitating power of the chlorides, sulphates, and nitrates, and diminishes that of the acetates. The alkaline acetates are rather more efficient than the chlorides, in throwing down waterglass; but acetate of soda gives only very slight precipitates with $Na\,O,\ 2\frac{1}{4}\ Si\,O_2$, and this after standing some time. Nitrate of soda has but very little effect upon the more alkaline silicates. Sulphate of soda has still less precipitating power than the nitrate. Normal carbonate of soda is devoid of precipitating power; and normal (tris) arseniate, and phosphate, of soda has little or no effect. Bisulphate, bicarbonate, diphosphate, and dinarseniate of soda all act as acid salts, throwing down gelatinous silica. (Ordway, *Am. J. Sci.*, (2.) **35.** pp. 185 – 193. The results of numerous *quantitative* experiments are given by O. in this memoir. Compare *Ibid.*, **32.** 340.) Ammonia salts throw down silica from a strong solution of waterglass, while ammonia is evolved, silicate of ammonia being a compound apparently incapable of more than a momentary existence under the ordinary pressure of the atmosphere. (*Ibid.*, **32.** 340.) Of course most earthy and metallic salts effect a double decomposition when mixed with alkaline silicates, and generally a thickening of the whole mass very soon ensues. But sulphate and carbonate of baryta seem to be without action, and so does fluoride of calcium. Most lime salts, whether soluble or insoluble, are particularly energetic in their operation; carbonate of lime does not produce any decided change, yet when it is boiled with a very siliceous silicate it becomes flocculent, showing that there is a partial exchange of constituents. The basic carbonates of zinc and magnesia, and the carbonates of lead and manganese produce an immediate coagulation, as does also carbonate of ammonia. (*Ibid.*, **32.** 339.) Baryta, strontia, and lime-water, and likewise a solution of aluminate of potash throw down the whole of the silica, together with part of the potash, in the form of a double silicate, the rest of the potash remaining in the liquid in the free state. (Guyton-Morveau, *Ann. Chim.*, **31.** 246; Bucholz, *Taschenb.*, 1812, p. 156; Dœbereiner, *Schw.*, **10.** 113 [*Gm.*].) Zincate of soda mixed with a cold aqueous solution of waterglass at first shows no change, but a precipitate soon forms. In like manner aluminate and glucinate of soda speedily cause a precipitation. But manganate, stannate, and chromate of soda produce no alteration. (Ordway, *Am. J. Sci.*, (2.) **32.** 339.)

When an aqueous solution of waterglass is evaporated to dryness, and the whole of the water expelled by ignition, a part of the silica goes over into the passive state, and the mass is consequently no longer completely soluble in water. (Ordway, *Am. J. Sci.*, (2.) **32.** 342.) Fremy found that after $RO, 4\frac{1}{2}\,SiO_2$ has been carefully dried, water dissolves the alkali out of the residue, and leaves the silica, which last, according as the heat has been more or less intense, is or is not soluble in dilute alkalies. The compounds $RO, 2\frac{1}{4}\,SiO_2$ also he found to be decomposable by heat, but the compounds $RO, 1\frac{1}{2}\,SiO_2$ were ascertained to be unchanged by dehydration. (*Ibid.*)

When a dilute acid is added to a weak solution of a silicate there is no immediate precipitation of silica, but after some hours the whole gelatinizes. With sulphuric acid the coagulation comes on soon; but with chlorhydric acid the change is delayed a long time, and the mixture may sometimes even be heated and partially evaporated and still remain liquid. (Ordway, *Am. J. Sci.*, (2.) **32.** pp. 340, 164.) Almost any sample of waterglass may be rendered more siliceous by adding a portion of dilute acid to its aqueous solution, in order to neutralize a part of the base, and then precipitating with alcohol. But in doing this it is necessary to precipitate with alcohol very soon after the addition of the dilute acid; otherwise, under the influence of the neutral salt formed, the silicate gradually undergoes a change of state and finally gelatinizes. Nitric acid is peculiarly suitable for withdrawing the alkali, because the nitrates have less modifying power than most other salts. (*Ibid.*, **33.** 32.)

A solution of waterglass so far diluted as to contain from $\frac{1}{10}$ to $\frac{1}{40}$ pt. of silica solidifies immediately when exactly neutralized with an acid, and forms a solid, transparent jelly. With $\frac{1}{50}$ @ $\frac{1}{100}$ pt. of silica it does not form a jelly till after the lapse of twelve hours; with $\frac{1}{500}$ pt. of silica, no reaction takes place. The slightest excess of acid prevents the formation of the jelly. If a current of carbonic acid gas is passed through a solution containing $\frac{1}{100}$ pt. of silica, no jelly is formed till the liquid has been boiled, or exposed to the air. With sulphate or chlorhydrate of ammonia, a solution of the above strength forms a jelly after a few minutes; a solution containing $\frac{1}{500}$ @ $\frac{1}{1000}$ pt. of silica deposits a few flakes in the course of 24 hours. (Walcker, *Quar. J. Sci.*, (N. S.) **3.** 371 [*Gm.*].) For further details of the action of acids upon solutions of the alkaline silicates, see above, under Silicic Acid.

a' = *Precipitated Waterglass.* The hydrated compounds obtained by precipitating aqueous solutions of ordinary waterglass with saline solutions, or with alcohol or wood-spirit, as above described, deserve to be here mentioned under a special heading, although their behavior with solvents has already been alluded to under the preceding title. These hydrates which, as Ordway states, may be regarded as compounds of NaO, SiO_2, with varying amounts of $SiO_2, (HO)_x$ are not only very much more readily soluble in water than ordinary fused waterglass, but they also dissolve in water without decomposition, thereby differing, to a certain extent, from the fused glass, which, when more siliceous than $NaO, 2\frac{1}{4}\,SiO_2$, undergoes partial decomposition in dissolving in pure water, as stated above.

After having been freed from foreign matter by expression, all the precipitates less siliceous than $RO, 4\frac{1}{2}\,SiO_2$, are wholly soluble in cold water. After being exposed to the air for a day or two, in a warm place, they lose 20% or more of their weight, and become dry and hard, but their solubility remains unimpaired. A very hard, precipitated product a little more siliceous than $NaO, 4\frac{1}{2}\,SiO_2$, afforded a clear solution with four times its weight of cold water, being taken up completely except a thin external film of silica. A potash salt, of composition $KO, 4\frac{7}{10}\,SiO_2$, dissolved completely in cold water while new, yielding a perfectly clear solution; but exposure to the air for several days rendered the superficial portions insoluble (Ordway, *Am. J. Sci.*, (2.) **35.** 192; **33.** pp. 32, 30, 34.)

IV.) *Ordinary Glass.* A few facts concerning the action of solvents upon *ordinary glass* may here be cited. The glasses of commerce are mixtures in various proportions of an acid silicate of potash or soda, or of both, with an acid silicate of some one, or more, of the alkaline earths or metallic oxides, the latter being most commonly silicate of lime, but sometimes silicate of lead, as in flint glass, &c. In green bottle-glass the easily fusible silicate of iron replaces in part the fixed alkaline silicate.

Pure silicate of potash or soda, or a mixture of the two, even with a sufficient quantity of silica to form a very infusible glass, would still be attacked by water and acids. Silicate of lime is likewise acted on by acids, but a mixture of it with silicate of potash or soda resists their action much more strongly. Ordinary glass is more easily attacked by water and acids, the greater the excess of potash, soda, baryta, lime, magnesia, or oxide of lead which it contains, an excess of lead rendering it peculiarly liable to be corroded by acids. (Gmelin's *Handbook.*)

Glass, as that of a flask, is decomposed to a considerable extent, by long-continued [several days] boiling with water, a portion of the fixed alkali being dissolved; but when powdered glass is rubbed with distilled water during two hours in a glass mortar, the water remains pure and exhibits no alkalinity. (Scheele, cited by Pelouze, *C. R.*, **43.** 117.) Glass, of alembics, is partially dissolved after long-continued boiling with water. (Lavoisier, *Ibid.*) Water extracts potash or soda from glass, together with a portion of silica, the decomposition taking place with greater ease in proportion as the glass is richer in these alkalies, and more minutely divided, and the temperature of the water higher. The powder filed off from a tube of white glass reddens moistened turmeric-paper. (Bischof, *Kastner's Archiv.*, **1.** 443 [*Gm.*].) Finely pounded plate-glass acts in a similar manner. (Faraday, *Pogg. Ann.*, **18.** 569 [*Gm.*].) Fuchs (*Kastner's Archiv.*, **5.** 396 [*Gm.*]) says that with pure quartz and pure potash an insoluble glass cannot be prepared. "For if we take two parts of quartz to one of potash, we obtain — as I have convinced myself — a glass which partly dissolves in water." This mixture would make about $KO, 5\,SiO_2$. "Besides, even glass containing lime is more or less attacked by boiling water, as has long been known, and as Scheele especially proved. I found that many a glass, when it is rubbed a long time in an agate mortar, reacts very sensibly alkaline, and that when finely powdered glass is boiled for many hours with water, a fluid is obtained which has an alkaline reaction, and gives a flocculent precipitate with sal-ammoniac." (Cited by Ordway, *Am. J. Sci.*, (2.) **32.** 162.) Water does not act upon all kinds of glass; but there are, nevertheless, many kinds that it tends to decompose into a soluble alkaline silicate, and an insoluble earthy and alkaline silicate. Window-glass, and other varieties of analogous composition, are altered in this manner, and to a very considerable extent, by boiling water, as was long ago noticed by Scheele. Hence water which is boiled for a long time in glass vessels becomes alkaline, and also cloudy, owing to the insoluble earthy silicate, which is a residue of the action, and, being detached from the walls of the vessel, remains suspended in the water. This effect is even so pronounced upon crown-glass, and some varieties of window-glass, &c., that it is only necessary to reduce them to fine powder, and place this in contact with cold water, in order to obtain an alkaline reaction. (Dumas, *Tr.*, **6.** 428.) An alkaline reaction is exhibited by the powder of bottle-glass, and also of devitrified glass formed from it; of plate-glass, crown-glass, flint-glass, and white enamel. After sufficient washing, it no longer reddens turmeric-paper, unless it be recrushed in a mortar. 100 pts. of finely divided flint-glass, boiled for a week with water, lose 7 pts. of potash, which may be recovered in the solid state by evaporation. (Griffiths, *Quar. J. Sci.*, **20.** 258 [*Gm.*].) The moisture in the atmosphere produces a similar alteration, separating the potash and soda, and leaving the greater part of the silica with the lime on the surface of the glass. (Griffiths.) Retorts of ordinary glass, and those of flint-glass, are partially dissolved when water is evaporated in them. (Chevreul, 1811, cited by Pelouze, *C. R.*, **43.** 118.) Flint-glass, green bottle-glass, green German glass, and hard, white Bohemian glass, when finely powdered in an agate mortar, and treated with distilled water at the ordinary temperature, all exhibit well-marked alkaline reactions. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, (2.) **5.** 401.). All the varieties of glass which occur in commerce, — such as mirror and window-glass, bottle-glass, crystal, flint-glass, and the other glasses employed for optical instruments, — when reduced to fine powder and left in contact with the air decompose slowly, with absorption of carbonic acid, so that after a little time they effervesce with acids. The same effervescence is produced when an acid is added to a mixture of powdered glass and water which has been exposed to the air during several days; the acid solution thus obtained contains a large quantity of soda and lime, also almost always some sulphuric acid from a trace of sulphate of soda contained in the glass. All glasses, when in fine powder, exhibit an immediate alkaline reaction with colored vegetable solutions; this is a consequence of their instantaneous alteration by water. Powdered glass which has been acted upon by cold water is further decomposed by boiling water, as is noted below. Devitrified glass behaves with water like ordinary glass, only it appears to be still more easily decomposed. (Pelouze, *C. R.*, 1856, **43.** pp. 121, 122.)

While water only acts with excessive slowness upon vessels of glass in which it is boiled, and with infinitely less energy upon these vitreous surfaces when it is cold, it is nevertheless capable of decomposing powdered glass with an extraordinary facility. Thus a phial of about 500 c. c. capacity lost scarcely 0.1 grm. of its weight after water had been boiled in it during five days, but when the neck of this phial was cut off, reduced to powder and boiled in the same vessel during the same space of time, decomposition occurred to the extent of one third the weight of the phial. On the other hand, a vessel which might have held water for years without experiencing any sensible loss of weight, at once undergoes a decomposition representing 2 @ 3% of its weight, if, after having reduced it to powder, it be placed in contact with cold water during a few minutes. A sample of the best commercial white glass, which afforded, on analysis, 72.1% of silica, 12.4% of soda, 15.5% of lime, — [8 Na O, 11 Ca O, 48 Si O_2,] — together with traces of alumina and oxide of iron, having been reduced to powder and ground very finely upon an agate plate, 5.51 grms. of it were boiled with distilled water in a porcelain dish, the water being renewed as it evaporated. The clear liquid obtained from this treatment being evaporated to dryness, the ignited residue weighed 0.175 grm. [= 3.18%]. The portion insoluble in water, which effervesced with dilute acids, contained 0.078 grm. of lime, a weight corresponding to 1.5% of the glass employed. As the glass in question contained 15% of lime, we may conclude that water decomposes about 10% of the glass. Of another sample of first quality glass which contained 77.3% of silica, 16.3% of soda, 6.4% of lime, — [8 Na O, 4 Ca O, 39 Si O_2], — and traces of alumina and oxide of iron, 5.18 grms. were taken, the experiment being conducted as the foregoing instance. There was obtained 0.945 grm. [= 18.24%] as the residue of the aqueous solution, and 0.103 grm. as the weight of lime, i. e. 2% of the weight of the glass employed. As the glass contained 6.4% of lime, it follows that 32% of the glass was destroyed in this second experiment. The residue of the aqueous solution being analyzed was found to contain 0.281% of soda, or 5.6% of the weight of the glass employed, the remainder being silica. As the glass contained 16.3% of soda, this result would indicate that 34% of the glass had been attacked. In spite of the difference of 2% between the numbers derived from the soda and the lime, it may safely be affirmed that all the basic portion of the glass is extracted from the portion destroyed, and that by a sufficiently prolonged action, nothing but silica would be left if an exceedingly fine powder were operated upon. After five days' ebullition, a sample of ordinary glass, similar to that first mentioned, had undergone decomposition to the extent of one third of its weight, — the silicate of soda given up to the water having in each case the formula 4 Na O, 9 Si O_2. Crystal, in fine powder, having been agitated during a few instants with cold water mixed with a very small quantity of acid, affords a precipitate of sulphide of lead when treated with sulphuretted hydrogen. After half an hour's ebullition with water and the addition of an acid, 5 grms. of powdered crystal furnished 0.05 grm. of sulphide of lead, a figure which corresponds with the decomposition of about 3% of the crystal. Flint-glass, which contains more lead than crystal, experiences a still more considerable decomposition. The extraordinary rapidity and ease with which powdered glass is decomposed, as compared with the great stability of vessels and other objects of moulded or blown glass, might almost lead one to ask whether the latter were not in a peculiar condition, possessing properties different from those of the former; but this is improbable, in view of the stability of the surfaces of "polished" glass, i. e. those in which the natural surface has been removed. And it appears to be more simple to refer these differences to different conditions of cohesion and mechanical resistance. The multiplicity of surfaces and facility of movement of powdered glass hasten its alteration by water. (Pelouze, *C. R.*, 1856, **43.** pp. 119 - 123.) When finely powdered glass — for example, flint-glass, green bottle-glass, hard, white Bohemian glass, or green German glass — is treated for a few moments at the ordinary temperature with carbonic acid water, it is partially decomposed and dissolved. (W. B. & R. E. Rogers, *Am. J. Sci.*, 1848, **5.** 401.) When finely powdered glass is boiled with water through which a current of carbonic acid is caused to pass, this gas is absorbed, and in a few instances the powder effervesces when treated with acids. (Pelouze, *C. R.*, 1856, **43.** 121.) When boiled during several hours with sulphate of lime, powdered glass produces a notable quantity of sulphate of soda. (Pelouze, *C. R.*, **43.** 121.)

The acids act upon glass with more or less facility. Fluorhydric acid especially attacks all kinds of glass quickly and easily, a hot concentrated solution of phosphoric acid likewise decomposes every variety; the other acids also tend to decompose glass, abstracting the bases and setting free the silica. Many of the green bottle-glasses, which resist the action of wine, are strongly attacked by nitric, chlorhydric, and sulphuric acids. Bottle-glass which contains too much alumina is one of the kinds most easily attacked by acids; glass of this sort sometimes occurs which is so quickly acted upon by the bitartrate of potash contained in wine that its alteration may even be appreciated after the lapse of a few days; besides the corrosion of the bottle itself and the deposition of salts, the alumina salt formed enters into solution, discolors the wine, and communicates to it a disagreeable taste. (Dumas, *Tr.*, **6.** 430, and *Gm.*) On pounded glass the acids act with much greater energy. From pulverized flint-glass, boiling chlorhydric acid extracts potash only, not the oxide of lead. (Griffiths.) Glass which is poor in silica is attacked by boiling concentrated sulphuric acid; and glass of yet inferior quality is acted on by boiling chlorhydric and nitric acids, and aqua-regia, a dull spot remaining after the evaporation of the acid. (Berzelius.) In distilling chlorhydric acid from a green glass retort, a portion of the latter was dissolved. (Hess, *Pogg. Ann.*, **20.** 540 [*Gm.*].) Glasses which contain lead are the more readily attacked by acids in proportion as they are richer in lead; a good quality of crystal resists them very well. So too with window-glasses, when too strongly alkaline they are attacked very readily, but when well made they withstand the acids. When a glass has been *dépolit* by exposure to a dull, red heat, it is sure to be attacked by acids when treated therewith. (Dumas, *Tr.*, **6.** 431.) Glass is attacked not only by the vapor of fluorhydric acid, but also by the vapor of sulphuric acid, and with more or less energy by the vapors of all acids. (J. Nicklès, *C. R.*, 1857, **44.** pp. 680, 681.) Many ammonia salts containing the stronger acids also attack glass, especially lead glass, when heated in contact with it; such is the case with a mixture of chloride of ammonium and nitrate of ammonia (Silliman), or with sulphate or bisulphate of ammonia. (Marchand, *Pogg. Ann.*, **42.** 556 [*Gm*].) Glass dissolves with various degrees of readiness in a hot solution of caustic potash. (Lœwitz.)

Solutions of potash and soda decompose glass to a certain extent, dissolving out the silica with greater ease in proportion as they are more concentrated and hotter; even at ordinary temperatures they partially dissolve the white glass bottles and other vessels in which they are ordinarily kept, frequently causing the glass to crack. (Gmelin, in his *Handbook*, **3.** pp. 384, 14.) Even ammonia-water attacks many kinds of glass. A bottle made of flint-glass, and containing a solution of carbonate of ammonia, became so fragile that, on shaking it, pieces of glass were detached. (Griffiths.)

SILICATE OF STRONTIA. Containing 3 equivalents of strontia is sparingly soluble in water, but readily soluble in dilute acids. (Vauquelin.)

SILICATE OF THORIA. Occurs as the mineral *Thorite*. After having been ignited, this is scarcely at all acted upon by chlorhydric acid; but when unignited, it is completely decomposed by hot chlorhydric acid, with separation of gelatinous silica. (Berzelius, *Pogg. Ann.*, 1829, **16.** 388.)

$2\,\mathrm{Th\,O,\,Si,O_2} + 2\,\mathrm{Aq}$

SILICATE OF ZINC.

I.) *basic.*

$a = 2\,\mathrm{Zn\,O,\,Si\,O_2}$ Occurs as the mineral *Willemite*, which is soluble, for the most part, in an aqueous solution of caustic potash, and dissolves readily in acids with separation of a siliceous jelly.

$b = 2\,\mathrm{Zn\,O,\,Si\,O_2} + \mathrm{Aq}$ Occurs as the mineral *Calamine*. Readily soluble in acids, even in acetic acid, with separation of a siliceous jelly. Soluble, for the most part, in potash lye.

SILICATE OF ZIRCONIA.

I.) *basic.* Occurs as *Zircon*, or *Hyacinth*. Is not decomposed by acids, not even by fluorhydric acid; hot concentrated sulphuric acid, however, acts upon it slightly. (Berzelius.)

$2\,\mathrm{Zr_2\,O_3,\,3\,Si\,O_2}$

SILICIDE OF BISMUTH.

SILICIDE OF IRON. Insoluble in hot water. Soluble, with decomposition, in acids, even in hydrofluosilicic acid. (Berzelius.)

SILICIDE OF PLATINUM. Less easily soluble than platinum in aqua-regia. (Boussingault.)

SILICIDE OF POTASSIUM. Decomposed by water. (Berzelius.)

SILICOFLUORIDE OF *X*. *Vid.* FluoSilicate of *X*.

SILICON. (*Silicium.*)

I.) *pulverulent.*

α = recently prepared. Insoluble in and unacted upon by water, sulphuric, or nitric acid, or aqua-regia, even when boiled with them. But is dissolved even in cold liquid fluorhydric acid and in a warm concentrated aqueous solution of caustic potash. (Berzelius, *Lehrb.*, **1.** 323.)

$\mathrm{Si} + x\,\mathrm{Aq}$

β = ignited. Unacted upon by fluorhydric acid, or by potash lye, even when these are boiling, but is very easily dissolved by a mixture of nitric and fluorhydric acids. (Berzelius, *Ibid.*)

II.) *graphite-like.* Unacted upon by any acid. Slowly, but completely, soluble in tolerably concentrated warm potash or soda lye, with evolution of hydrogen. (Wœhler.)

III.) *amorphous.* After ignition it is insoluble in all acids, but dissolves in potash or soda lye.

SILICURETTED HYDROGEN. Insoluble in pure water free from air, in an aqueous solution of chloride of sodium, or in dilute chlorhydric or sulphuric acid. Decomposed by a solution of potash. (Wœhler & Buff, *Ann. Ch. u. Pharm.*, **103.** 224.)

SILVER. Unacted upon by water. Insoluble in the vegetable acids. Insoluble in dilute sulphuric or phosphoric acid. Only slightly attacked by boiling chlorhydric acid, but a mixture of chlorhydric and arsenic acids attacks it

Ag

vigorously. Warm concentrated iodhydric acid, on the other hand, dissolves it with evolution of hydrogen, though it is insoluble in dilute iodhydric acid. Nitric acid dissolves it even in the cold. Soluble in hot concentrated sulphuric acid, in cold fuming sulphuric acid, and in arsenic acid.

Iodhydric acid attacks silver with extraordinary energy, hydrogen being evolved. After the action has ceased at the ordinary temperature, because the acid is saturated with iodide of silver, it may be reincited by heating the mixture. (H. Deville, *C. R.*, 1856, **42.** 895.) A warm concentrated solution of iodide of potassium converts it into iodide of silver, which dissolves in the excess of iodide of potassium.

Silver is not attacked by pure dilute nitric acid (of 1.405 sp. gr., or less) so long as the temperature is low. It is attacked, however, by dilute nitric acid which contains nitrous acid. In pure concentrated nitric acid the silver is soon covered with a gray or white coat, which arrests further action. [Compare Copper.] (Millon, *Ann. Ch. et Phys.*, (3.) **6.** 98.) Slightly soluble at the ordinary temperature in an aqueous solution of sulphate of sesquioxide of iron, and more readily if this contain free sulphuric acid (Wetzlar, *Schweigger's Journ. für Ch. u. Phys.*, 1828); more readily soluble in a boiling solution of persulphate of iron, dissolving completely, even when the solution is made as nearly neutral as possible by the introduction of hydrated sesquioxide of iron; in this reaction a portion of the sesquioxide of iron is reduced to protoxide. Completely insoluble in, and unacted upon, by a boiling aqueous solution of pure sulphate of protoxide of iron; but if even a slight quantity of sesquioxide of iron be present in the solution, silver will dissolve in it on boiling, though in presence of so much protoxide of iron a portion of the silver is reduced to the metallic state as the solution cools. (A. Vogel, *J. pr. Ch.*, 1840, **20.** 362.) When boiled in an aqueous solution of protochloride of mercury, the latter is reduced to dichloride, which is precipitated together with the insoluble chloride of silver which forms. (A. Vogel, *J. pr. Ch.*, 1840, **20.** 365.)

SINAMIN. Easily soluble in water, alcohol, and ether. (Robiquet & Bussy; Will.)
(*Allyl Cyanamin.*)
$C_8H_6N_2 = N\left\{\begin{matrix}C_6H_5\\C_2N\\H\end{matrix}\right. \& + Aq$

SINAPIC ACID. Very slowly soluble in cold, somewhat more readily soluble in boiling water, and alcohol. Insoluble in ether. Almost insoluble in acids. Easily soluble with combination in alkaline solutions. (V. Babo & Hirschbrunn.)
$C_{22}H_{12}O_{10}$

The alkaline salts of sinapic acid are readily soluble in water, those of the alkaline earths are difficultly soluble; most of the sinapates are very easily decomposed.

SINAPATE OF AMMONIA. Readily soluble in water.

SINAPATE OF BARYTA. Difficultly soluble in water.
$C_{22}H_{10}Ba_2O_{10}$

SINAPATE OF POTASH. Soluble in water. Insoluble in absolute alcohol.

SINAPATE OF SODA. Soluble in water.

"SINAPIN" (of Berzelius). *Vid.* SulphoCyanhydrate of Sinapin.

SINAPIN. Soluble in water, but the aqueous solution is decomposed on evaporating it. (V. Babo & Hirschbrunn.)
$C_{32}H_{23}NO_{11}$

SINAPOLIN. Soluble in water, abundantly at the temperature of boiling, in alcohol, and ether. Readily soluble, without decomposition, in cold concentrated sulphuric acid; also soluble in other acids, from which it is precipitated by ammonia. (Simon; Will.) It is neither dissolved nor decomposed by potash lye.
(*DiAllyl Urea. Cyanate of diAllylammonium.*)
$C_{14}H_{12}N_2O_2 = N_2\left\{\begin{matrix}C_2O_2''\\(C_6H_5)_2\\H_2\end{matrix}\right.$

SINETHYLAMIN. *Vid.* EthylSinamin.

SINKALIN. Exceedingly deliquescent. Soluble in water. (V. Babo & Hirschbrunn.)
(*Sincalin.*)
$C_{10}H_{13}NO_2$

SIPEERIN. *Vid.* Sepeerin.

SMILACIN (from *Smilax Sarsaparilla*). Readily soluble in boiling, less soluble in cold water, and alcohol. Soluble in ether and the volatile oils, less soluble in the fatty oils. Also soluble in dilute alkaline solutions and in dilute acids.
(*Pariglin. Sarsaparillin.*)
$C_{16}H_{15}O_6$? or $C_{18}H_{15}O_6$?

SOAPS. In ordinary language, the term soap is applied to mixtures of various compounds of the fatty acids with alkaline bases; but sometimes the term is made to include the compounds of fatty acids with other metallic oxides. Taking it in the most general sense, it may be said that all soaps, excepting those of potash, soda, ammonia, (and lithia?), are insoluble in water, and but difficultly soluble or insoluble in alcohol. The ordinary soaps, however, i. e. those with an alkaline base, are readily soluble in boiling water and in boiling alcohol. When the moderately concentrated aqueous solution is treated with a large excess of water the soap is decomposed, an acid salt separates out, while an equivalent quantity of the alkaline base remains in solution. The soaps most commonly employed are mixtures, in variable proportions, of the stearates, margarates, palmitates, and oleates of soda or of potash. Those in which the base is soda are always more consistent and less readily attacked by water than the potash soaps. On the other hand, those soaps in which the oleates predominate are less consistent than those containing more of the solid fatty acids.

The alkaline soaps are insoluble in aqueous solutions of sebate of potash or sebate of soda, — as they are in solutions of chloride of sodium. (Bouis, *Ann. Ch. et Phys.*, (3.) **48.** 105.)

SOAPS *of the protoxide* OF IRON are soluble in oil of turpentine, and the other essential oils.

SODA. *Vid.* Oxide of Sodium.

SODIUM. Decomposed by water, alcohol, wood-spirit, ether, and in general by all oxygenated substances. Insoluble in naphtha, &c.
Na

The compounds of sodium are nearly all readily soluble in water, except the antimoniate, tartrate, fluorhydrate, and picrate, which are somewhat sparingly soluble.

SODIUMAMID. Decomposed by water, and alcohol.
$N\left\{\begin{matrix}H_2\\Na\end{matrix}\right.$

*Tri*SODIUMAMID. *Vid.* Nitride of Sodium.
$N\left\{Na_3\right.$

SODIUMETHYL. Not isolated.
C_4H_5Na

SODIUMETHYL with ZINCETHYL. Decomposed by water. Soluble in zincethyl.
$C_4H_5Na;\ 2\,C_4H_5Zn$

Solanin. Permanent. Sparingly soluble in cold water, alcohol, ether, and the fatty and essential oils. Soluble in boiling alcohol. Soluble in concentrated sulphuric and nitric acids.

$C_{42}H_{35}NO_{14} = N\left\{\begin{matrix}C_{42}H_{33}O_{14}\\H_2\end{matrix}\right.$

The salts of solanin are generally readily soluble in water, and spirit.

"Sorbic Acid" (of Donovan). See Malic Acid.

Sorbic Acid. Almost insoluble in cold, tolerably soluble in boiling water. Easily soluble in alcohol, and ether. The most convenient solvent is a mixture of 1 vol. alcohol and 2 vols. water. (Hofmann.)

$C_{12}H_8O_4 = C_{12}H_7O_3, HO$

Sorbate of Ammonia.

Sorbate of Baryta. Less soluble in alcohol than in water.

$C_{12}H_7BaO_4$

Sorbate of Copper. Ppt.

Sorbate of Ethyl.

$C_{12}H_7(C_4H_5)O_4$

Sorbate of Lead. Ppt.

Sorbate of Lime. Resembles the baryta salt.

$C_{12}H_7CaO_4$

Sorbate of Manganese. Ppt.

Sorbate of Nickel. Ppt.

Sorbate of Potash. Very soluble in water.

Sorbate of Silver. Insoluble in water.

$C_{12}H_7AgO_4$

Sorbate of Soda. Very soluble in water.

Sorbate of Zinc. Ppt.

Sorbinic Acid. Insoluble in water, alcohol, or feeble acids. Very readily soluble in aqueous solutions of caustic potash, soda, and ammonia. (Pelouze, *Ann. Ch. et Phys.*, (3.) **35**. 227.)

$C_{32}H_{17}O_{15} = C_{32}H_{13}O_{11}, 3HO + Aq$

Sorbinate of Alumina. Ppt.

Sorbinate of Ammonia. Soluble in water.

Sorbinate of Baryta. Ppt.

Sorbinate of Cobalt. Insoluble in ammonia-water.

Sorbinate of Copper. Soluble in ammonia-water.

Sorbinate of Gold. Ppt.

Sorbinate *of sesquioxide* of Iron. Ppt.

Sorbinate of Lead.

$C_{32}H_{13}Pb_3O_{15}$

Sorbinate of Lime. Ppt.

Sorbinate of Nickel. Soluble in ammonia-water.

Sorbinate of Platinum. Ppt.

Sorbinate of Potash. Soluble in water.

Sorbinate of Soda. Soluble in water.

Sorbinate *of protoxide* of Tin. Ppt.

Sorbin (from *Sorbus aucuparia*). Soluble in about 0.5 pt. of water. Very sparingly soluble in boiling and still less soluble in cold alcohol. Unaltered by dilute, but is decomposed by strong, sulphuric acid. (Pelouze, *Ann. Ch. et Phys.*, (3.) **35**. 225.) The aqueous solution, saturated at 15°, is of 1.372 sp. gr.

(*Sorbite.*)

$C_{12}H_{12}O_{12} = \left.\begin{matrix}C_{12}H_{10}O_8{}''\\H_2\end{matrix}\right\}O_4$

Sorbin with Oxide of Lead. Ppt.

SpanioLitmin. Only sparingly soluble in water. Insoluble in alcohol or ether. Soluble in alkaline solutions. (Kane.)

$C_{18}H_{17}O_{16}$?

Spartein. Very sparingly soluble in water, but a little water is dissolved by it. Readily soluble in alcohol, and ether. Soluble, with combination, in dilute acids. Decomposed by hot chlorhydric and nitric acids.

$N\left\{C_{16}H_{13}{}'''\right.$

The salts of spartein are soluble in water.

Spermaceti. *Vid.* Palmitate of Cetyl.

Spermatin. Easily soluble in water. Insoluble in alcohol or ether. Soluble in cold concentrated sulphuric acid, from which it is precipitated on the addition of water. Soluble in warm nitric acid, from which it is precipitated on the addition of water. In concentrated acetic acid it swells up, and when the mixture is treated with water and boiled it dissolves.

Spiræin (yellow coloring matter of the flowers of *Spiræa ulmaria*). Insoluble in water. Readily soluble in alcohol, and ether. Soluble in concentrated sulphuric acid, from which it is precipitated unchanged on the addition of water. Soluble in warm concentrated nitric acid, by which it is altered only after prolonged ebullition. Insoluble in chlorhydric acid. Soluble in aqueous solutions of the caustic alkalies.

$C_{42}H_{24}O_{20}$(?)

Spirin. *Vid.* BenzoSalicyl.

Spirite of *X*. *Vid.* Salicylite of *X*.

Spirol. *Vid.* Phenic Acid.

Spirous Acid. *Vid.* Salicylous Acid.

Spiroylic Acid. *Vid.* Salicylic Acid.

Sponge (organic matter of the). Insoluble in water, alcohol, ether, ammonia-water, or dilute chlorhydric acid. Soluble in boiling concentrated chlorhydric acid, and partially soluble in nitric acid. Also soluble in boiling baryta-water.

Stann(*ous*)Amyl.

$\left.\begin{matrix}C_{10}H_{11}Sn\\C_{10}H_{11}Sn\end{matrix}\right\}$

Stann(*ic*)Amyl.

(*BistannAmyl.*)

$\left.\begin{matrix}C_{10}H_{11}Sn_2\\C_{10}H_{11}Sn_2\end{matrix}\right\}$

III.) $\frac{2}{2}$ *or methylene stannamyl.*

$(C_{10}H_{11})_2Sn_2$

IV.) $\frac{2}{3}$ *or methstannamyl.*

$(C_{10}H_{11})_3Sn_2$

The stannamyls are all insoluble in water; they are the less soluble in alcohol in proportion as they contain more tin; they are all readily soluble in ether.

V.) $\frac{2}{4}$ *or methstannbiamyl.* Readily soluble in alcohol, and ether.

$(C_{10}H_{11})_4Sn_2$

Stannic Acid. *Vid. bin*Oxide of Tin.

SnO_2

All the soluble stannates and metastannates are precipitated from their aqueous solutions on the addition of salts of potash. soda, or ammonia. All the metastannates, excepting those of potash, soda, and ammonia, are insoluble in water. (Fremy, *Ann. Ch. et Phys.*, (3.) **12**. pp. 474, 484.)

Stannate of Ammonia. Soluble in pure water. Insoluble in dilute ammonia-water. (Berzelius.)

$NH_4O, 2SnO_2$

*Meta*Stannate of Ammonia. Soluble in water. from which solution it is precipitated on the addition of alcohol. (Fremy, *Ann. Ch. et Phys.*, (3.) **12**. 474.)

Stannate of Baryta. Ppt.

$BaO, SnO_2 + 6Aq$

*Meta*Stannate of Baryta. Insoluble in water. (Fremy, *loc. cit.*, p. 477.)

Stannate *of sesquioxide* of Chromium.

Stannate of Cobalt.

Stannate *of dinoxide* of Copper.

Stannate *of protoxide* of Copper. Ppt.

$Cu O, Sn O_2 + 3 Aq$

Stannate of Gold. Insoluble in water. Insoluble in dilute chlorhydric acid. (Berzelins.) Slowly acted upon by boiling chlorhydric acid, with solution of some tin. (Proust; Fuchs.) Boiling nitric acid dissolves out some of the tin (Proust), as does also boiling dilute sulphuric acid. Aqua-regia dissolves out gold, leaving white oxide of tin. Chlorhydric acid dissolves out tin, leaving metallic gold. (Berzelius's *Lehrb.*) While still moist, purple of Cassius is generally soluble in ammonia-water, from which solution the purple is gradually redeposited, but some samples prepared from hydrated sesquioxide of tin and a solution of terchloride of gold or by dissolving an alloy of gold, silver, and tin in nitric acid, are insoluble in ammonia-water, even while they are yet moist; after drying, the purple is always insoluble in ammonia.

(Purple of Cassius.)
$Au O, 3 Sn O_2 + 4 Aq$

As ordinarily precipitated, purple of Cassius contains an excess of uncombined binoxide of tin, but this may be dissolved out by boiling the precipitate in an aqueous solution of caustic potash. The precipitate which has been thus treated dissolves in part in cold water, or rather a quasi-solution is produced, forming a strongly colored liquid, from which it may be completely reprecipitated by the addition of a little chloride of ammonium. (L. Figuier, *Ann. Ch. et Phys.*, (3.) **11.** 353.)

Stannate of Lead. Ppt. (Berzelius's *Lehrb.*) Appears to be somewhat soluble. (Moberg.)

$Pb O, Sn O_2$

Stannate of Lime. Ppt. Difficultly soluble in water. (Berzelius's *Lehrb.*)

$Ca O, Sn O_2 + 4 Aq$

Stannate of Magnesia. Ppt.

Stannate of Manganese. Ppt. Oxidizes when exposed to the air.

$Mn O, Sn O_2$

Stannate *of dinoxide* of Mercury. Ppt.

$Hg_2 O, Sn O_2 + 5 Aq$

Stannate *of protoxide* of Mercury. Ppt.

$Hg O, Sn O_2 + 6 Aq$

Stannate of Potash.

I.) *proto.* Easily soluble in water. (Moberg.) Insoluble in an aqueous solution of chloride of potassium. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 469.) Slightly hygroscopic. Very soluble in water, but water appears to decompose it after a time, a gelatinous metastannate being formed. Insoluble in alcohol. It is precipitated from its aqueous solution on the addition of almost any soluble salt, — notably by the salts of ammonia, of potash, and of soda. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 484.) On fusing calcined oxide of tin with hydrate of potash, and treating the mass with water, crystals of stannate (*a*) of potash may be obtained. These are completely soluble in water. Also easily and completely soluble in alcohol. The aqueous solution is not rendered cloudy on the addition of a solution of potash. Nor is it precipitated on the addition of solutions of the chlorides of sodium, or potassium, or of sulphate of potash. A solution of chloride of ammonium occasions no precipitate at first, but forms an abundant precipitate after a time. In presence of dilute sulphuric acid, chlorhydric, or nitric acid, the solution remains clear. (H. Rose, *Tr.*, **1.** 251.) When prepared by dissolving hydrate of tin in a solution of caustic potash it is difficultly soluble in a concentrated aqueous solution of caustic potash. (H. Rose, *Tr.*, **1.** 245.)

$K O, Sn O_2$

II.) *acid.* Soluble in water, forming a milky liquor. Insoluble in alcohol. (Berzelius.)

***Meta*Stannate of Potash.** Generally it is soluble in water, but is liable to become insoluble in water when merely dried at the ordinary temperature. Alcohol precipitates it from the aqueous solution. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 474.) Soluble in water. Completely insoluble in a large excess of an aqueous solution of caustic alkali. Insoluble in alcohol. (Fremy, *loc. cit.*, (3.) **23.** 394.) On adding a solution of chloride of sodium to the aqueous solution an abundant precipitate is produced, and no tin remains in solution; solutions of the chlorides of potassium and ammonium and of sulphate of potash behave in the same way, but on washing these precipitates with water they dissolve. (H. Rose, *Tr.*)

$K O, Sn O_2 + 4 Aq$
($K O, Sn_5 O_{10}$, according to Fremy.)

Stannate of Silver. Unacted upon by ammonia-water, or boiling chlorhydric acid. (Fischer.)

***Meta*Stannate of Silver.** Insoluble in water. (Fremy.)

Stannate of Soda. Soluble in water. (Moberg.) Insoluble in an aqueous solution of chloride of sodium. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 469.) Much more soluble in *cold* than in hot water. Insoluble in alcohol. It is precipitated from the aqueous solution on the addition of salts of potash, of soda, or of ammonia. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** pp. 486, 484.) When a certain amount of alcohol is added to an aqueous solution of stannate of soda, a concentrated aqueous solution of the latter is thrown down; but when a larger quantity of alcohol is employed crystals separate. (Ordway, *Ann. J. Sci.*, (2.) **33.** 35.)

$Na O, Sn O_2$

***Meta*Stannate of Soda.** While still moist it is soluble in water; but by drying it is decomposed and becomes insoluble. Alcohol precipitates it from the aqueous solution. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 477.) Very difficultly soluble in water. Insoluble in alcohol. Completely insoluble in a large excess of an aqueous solution of caustic alkali. (Fremy, *loc. cit.*, (3.) **23.** pp. 394, 399.)

$Na O, Sn O_2 + 4 Aq$
($Na O, Sn_5 O_{10}$ of Fremy.)

***Meta*Stannate of Strontia.** Insoluble in water. (Fremy.)

***Meta*Stannate of Tin.** Insoluble in water. Soluble, with decomposition, in acids and in alkaline solutions. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 479.)

(Yellow oxide of Tin.)
$Sn O, Sn O_2 + 3 Aq$

Stannate of Zinc.

$Zn O, Sn O_2 + 2 Aq$

Stann(*ous*)Ethyl. Insoluble in water. Sparingly soluble in absolute alcohol. Readily soluble in ether. (Lœwig; Frankland.) Very easily soluble in alcohol. (Cahours.)

(MethyleneStannEthyl. EthyleneStannEthyl.)
$\left.\begin{matrix} C_4 H_5 Sn \\ C_4 H_5 Sn \end{matrix}\right\}$

Stann(*ic*)*di*Ethyl. Nearly insoluble in water. Sparingly soluble in alcohol. Readily soluble in ether. Unacted upon by concentrated acids at the ordinary temperature, but when heated therewith it is decomposed. (Buckton.)

(*Stannic Ethide.*)
$Sn\,(C_4\,H_5)_2$

***Bi*Stann(*ic*)*tri*Ethyl.** Insoluble, or but sparingly soluble, in alcohol. (Cahours.) Lœwig enumerated seven different StannEthyls, viz.:

(*MethyloStannEthyl. SesquiStannEthyl.*)
$Sn_2\,(C_4\,H_5)_3$

a = Ordinary StannEthyl = $Sn\,C_4\,H_5$ (*vid. sup.*)
b = Methylene, or $\frac{2}{2}$ do. = $Sn_2\,(C_4\,H_5)_2$
c = Ethelene or Elayl, or $\frac{4}{4}$ do. = $Sn_4\,(C_4\,H_5)_4$
d = Aceto, or $\frac{4}{3}$ do. = $Sn_4\,(C_4\,H_5)_3$
e = Methylo, or $\frac{2}{3}$ do. = $Sn_2\,(C_4\,H_5)_3$
f = Ethylo, or $\frac{4}{5}$ do. = $Sn_4\,(C_4\,H_5)_5$
g = $\frac{6}{4}$ do. = $Sn_6\,(C_4\,H_5)_4$

All of which are insoluble in water. Sparingly soluble in absolute alcohol. Soluble in ether. Some of the oxides of the compounds are insoluble in water, alcohol, or ether, while others, sparingly soluble in water, are readily soluble in alcohol and ether.

Strecker, on the other hand, refers all of these compounds to three separate radicals, viz.:

StannEthyl = $Sn\,C_4\,H_5$ or $\left\{\begin{matrix} C_4\,H_5\,Sn \\ C_4\,H_5\,Sn \end{matrix}\right.$ as given above.

Bi Stann Ethyl = $Sn_2\,(C_4\,H_5)$

Bi Stannic tri Ethyl, or Methylo Stann Ethyl $\left.\begin{matrix} \\ \end{matrix}\right\}$ = $Sn_2\,(C_4\,H_5)_3$ as given above.

According to Strecker's view the bodies a, b, and c in the above list are identical. f is a mixture of a and e. While d is a mixture of a, with bistannethyl. (See *Gmelin's Handbook*, **13.** 505.)

***Sesqui*StannEthyl.** *Vid.* *Bi*Stann(*ic*)*tri*Ethyl.

StannEthylium. *Vid.* StannEthyl.

Stann(*ic*)EthylMethyl.
(*Stannic EthyloMethide*)
$Sn\left\{\begin{matrix} C_2\,H_3 \\ C_4\,H_5 \end{matrix}\right.$

StannicEthide. *Vid.* Stann(*ic*)*bi*Ethyl.

StannicEthylMethide. *Vid.* Stann(*ic*)-EthylMethyl.

Stannide of Methyl. *Vid.* StannMethyl.

Stannite of Potash.

Stannite of Soda.

StannMethyl.
$\left.\begin{matrix} C_2\,H_3\,Sn \\ C_2\,H_3\,Sn \end{matrix}\right\}$

Staphisain (from *Delphinium Staphisagria*). Sparingly soluble in water. Soluble in absolute alcohol. Insoluble, or but sparingly soluble, in ether. Soluble in acids.

Starch. When in its natural state of aggregation it is insoluble in cold water, alcohol, or ether. In hot water it swells up to a paste, and when boiled with much water appears to dissolve; but if the liquor thus obtained be exposed to temperatures below 0°, the water in congealing will deposit the starch, which regains a certain aggregation, and cannot be dissolved in water at the ordinary temperature; by long-continued boiling with water starch is converted into dextrin. When treated with dilute acids, it forms a paste in the cold, and when boiled with them is converted into dextrin and sugar. Strong acids disaggregate and decompose it much more rapidly, with the single exception of acetic acid, which, when concentrated, has no action upon it, and but little when it is diluted.

(*Amylum.*)
$C_{12}\,H_{10}\,O_{10} = \left.\begin{matrix} C_{12}\,H_8\,O_6'' \\ H_2 \end{matrix}\right\}O_4$

When covered with concentrated chlorhydric acid, and allowed to stand during several days, it dissolves. (Leuchs, *J. pr. Ch.*, 1841, **22.** 511.) Starch is dissolved, with decomposition, by sulphuric, nitric, chlorhydric, and oxalic acids, and probably by other acids (excepting acetic acid) in the cold, if the acid be concentrated, and gradually by the aid of heat and pressure when the acid is very dilute. (Biot, *Ann. Ch. et Phys.*, (3.) **11.** 101.) It is even gradually disaggregated and rendered soluble by the action of water containing only $\frac{2}{1000}$ of oxalic acid, if it be strongly heated therewith in a closed vessel. (Jacquelain, *Ann. Ch. et Phys.*, (3.) **11.** 102)

By the action of water at 150° starch is converted into dextrin and sugar. The same change is brought about, after a time, by dilute acids at the temperature of boiling. Concentrated sulphuric acid changes it to dextrin. When starch paste is treated with dilute sulphuric acid, glacial acetic acid, or better with ordinary acetic acid, it liquefies and passes into another molecular condition, viz. into Soluble Starch. (*Vid. infra.*) When treated with an aqueous solution of caustic alkali starch swells up enormously, and if this paste be heated, gently at first, it soon liquefies; from the solution thus obtained a mixture of acetic acid and alcohol precipitates a starch which, before drying, forms a translucid emulsion when treated with cold water; from this emulsion the starch subsequently separates, with the exception of a small quantity which remains in solution. Boiling water dissolves this precipitate no more than cold water, and the starch which has thus been disorganized by alkalies is no longer susceptible of forming a paste. The amount of this disorganized starch which is dissolved by water, either hot or cold, is always greater when one treats recently precipitated starch, than when one operates on that which has been already dried. After the starch has been boiled for a long time with a solution of caustic potash, a somewhat larger amount of it becomes soluble in water. These solutions, apparent or real, are, however, not permanent, and the starch which they contain may all be precipitated by alcohol. After long contact with alcohol, and subsequent drying, the starch is no longer soluble in water. When ordinary starch is treated with a solution of chloride of zinc, it swells up to a paste like that formed by warm water. This paste does not liquefy in the cold, but when heated to 100° it soon liquefies, and finally becomes quite fluid. From this solution alcohol precipitates a starch which behaves like that obtained from alkaline solutions. But if the paste produced by the action of chloride of zinc be heated over a free fire, and the solution which forms be precipitated as before by means of alcohol, a much more soluble variety of starch is obtained. To sum up the case: — Starch is modified insensibly without changing its nature, and passes from the insoluble state to another modification in which it is capable of dissolving in water. There are several varieties of "disorganized" starch, some of which are insoluble in water, either hot or cold. Others are soluble in water at the temperature of 80°, but the solution becomes cloudy on cooling. Others are soluble in cold and in hot water, forming solutions which remain clear on cooling. The latter Béchamp calls "soluble starch," and considers identical with the "amidin" of De Saussure and Geurin-Varry, and the "dextrin" of Biot.

When ordinary starch is treated with warm dilute sulphuric acid, the paste which is at first formed soon liquefies if heated to 90°, but solidifies again to a jelly on cooling. When treated with alcohol and dried it leaves a starch insoluble in water, and not susceptible of forming a paste with water. Nor can the jelly be again entirely liquefied when it is reheated; the portion of starch which remains in this case is entirely insoluble. When ordinary starch is treated with common nitric acid, a paste is obtained which is readily soluble in strong nitric acid, and the liquid thus obtained is readily soluble in water. Alcohol, however, precipitates from it all the starch which was originally employed. This precipitate, when recent, appears to dissolve in water, but most of it soon separates out again, and it is then no longer soluble either in cold or boiling water. The action of ordinary nitric acid is consequently similar to that of caustic potash, but is somewhat more rapid. By allowing the nitric acid to act for a longer time on the starch before precipitating with alcohol, a starch is obtained which is completely soluble in cold water, even after it has been dried at 100°. Concentrated sulphuric acid produces the same changes as nitric acid, only more rapidly. "Soluble starch" is precipitated from its solution in water or acid, by acetic acid, as it is by alcohol. When ordinary starch is treated with monohydrated acetic acid it is not disaggregated, but is rendered apt to dissolve in warm water, or even in cold water. Warm dilute acetic acid, by prolonged action, converts ordinary starch into soluble starch. (Bèchamp, *Ann. Ch. et Phys.*, (3.) **48.** 458.)

"*Soluble Starch.*" Under this heading Bèchamp (*loc. cit.*) distinguished several different products, as has been already indicated, of variable solubility. In its most characteristic form soluble starch dissolves in cold water when recently precipitated, and in warm water after it has been dried. These solutions may be frozen without causing anything to separate, and without altering in any way the properties of the soluble starch dissolved in them. They may also be evaporated to the consistence of a thick syrup without separating anything. Soluble starch is insoluble in alcohol, even dilute.

STEARIC ACID. Insoluble in water. Easily soluble in alcohol, even in dilute; and still more soluble in ether. More soluble in hot than in cold alcohol. Less soluble in alcohol than palmitic acid. Separates from the hot alcoholic solution somewhat sooner than margaric acid.

(*Stearophanic Acid. Anamirtic Acid. Bassic Acid.*)
$C_{36}H_{36}O_4 = C_{36}H_{35}O_3, HO$

Soluble in 40 parts of cold alcohol of 0.794 sp. gr., and in all proportions in the same alcohol when boiling. (Chevreul.) Ether dissolves 0.12 pt. of it. Soluble in 20 pts. of oil of turpentine. (Braconnot.) Soluble in wood-spirit, oil of turpentine, and coal-tar naphtha. (Hardwick.) Soluble in creosote. (Reichenbach.)

1 pt. of benzin dissolves 0.22 pt. of it at 23°. (Vogel & Scheller, *Dingler's Polytech. Journ.*, **164.** 221.)

1 pt. of bisulphide of carbon dissolves 0.3 pt. of it at 23°. (Vogel & Scheller, *Dingler's Polytech. Journ.*, **164.** 221.)

Easily soluble in aqueous solutions of the caustic alkalies. Soluble in concentrated sulphuric acid when this is gently warmed, from which solution it is precipitated on the addition of water.

The normal alkaline salts of stearic acid are soluble in small quantities (10 @ 20 pts.) of pure water, but are easily decomposed by large quantities of water. Only extremely small quantities of the alkaline stearates are dissolved by water which contains salts in solution, their aqueous solutions are therefore precipitated by saline solutions; for example, by a solution of chloride of sodium. All the other stearates are insoluble in water. The alkaline stearates are soluble in alcohol, especially if this is hot, though somewhat less so than the corresponding margarates. All the stearates are insoluble in ether, and, excepting those of the alkalies, in absolute alcohol also.

STEARATE OF AMMONIA.

I.) *normal.* Soluble in dilute ammonia-water, especially when this is warm.

II.) *acid.* Sparingly soluble in boiling water.

STEARATE OF AMYL. Very soluble in hot alcohol, and ether.
$C_{36}H_{35}(C_{10}H_{11})O_4$

STEARATE OF BARYTA. Insoluble in water, alcohol, or ether. (Hardwick, *J. Ch. Soc.*, **2.** 236.)
$C_{36}H_{35}BaO_4$

STEARATE OF BORNEOL. Soluble in alcohol, and ether.
(*Stearate of Camphol.*)
$C_{56}H_{52}O_4 = C_{36}H_{35}(C_{20}H_{17})O_4$

STEARATE OF CETYL. Slightly soluble in boiling alcohol. Easily soluble in boiling, but only sparingly soluble in cold ether.
$C_{36}H_{35}(C_{32}H_{33})O_4$

STEARATE OF CHOLESTERIN. Very sparingly soluble in boiling alcohol, or in cold ether. Difficultly soluble in boiling ether.
$C_{88}H_{78}O_4 = C_{36}H_{35}(C_{52}H_{43})O_4$

STEARATE OF COPPER.
$C_{36}H_{35}CuO_4$

STEARATE OF ETHYL. Insoluble in water, not being decomposed even by boiling water. Soluble in hot, less soluble in cold alcohol. Very soluble in ether.
$C_{36}H_{35}(C_4H_5)O_4$

STEARATE OF ETHYLENE. Soluble in ether. (Wurtz.)
$C_{72}H_{70}(C_4H_4'')O_8$

STEARATE OF GLYCERYL. *Vid.* Stearin.

STEARATE OF LEAD.

I.) *normal.* Very sparingly soluble in boiling alcohol or ether. Soluble in all proportions in hot oil of turpentine.
$C_{36}H_{35}PbO_4$

Stearate of lead [normal ?] is insoluble in water, alcohol, or ether. (Hardwick, *J. Ch. Soc.*, **2.** 236.)

II.) *acid.* Soluble, with partial decomposition, in more than 60 pts. of boiling alcohol of 0.823 sp. gr. Completely soluble in warm oil of turpentine.
$C_{36}H_{35}PbO_4, C_{36}H_{36}O_4$ (?)

III.) *basic.*
$C_{36}H_{35}PbO_4, 3PbO$

STEARATE OF LIME.
$C_{36}H_{35}CaO_4$

STEARATE OF MAGNESIA. Tolerably soluble in boiling, almost insoluble in cold alcohol. Insoluble, or nearly so, in water.
$C_{36}H_{35}MgO_4$

STEARATE *of dinoxide* OF MERCURY. Insoluble in water or in cold alcohol. Sparingly soluble in boiling alcohol. Readily soluble in ether.

STEARATE *of protoxide* **OF MERCURY.**

STEARATE OF METHYL. Insoluble in water.
$C_{36}H_{35}(C_2H_3)O_4$

STEARATE OF NICOTIN. Sparingly soluble in water. Readily soluble in warm ether.

STEARATE OF POTASH.

$C_{36}H_{35}KO_4$

I.) *normal.* Decomposed by water, forming a thick gelatinous paste (Chevreul); and with production of the bisalt, if enough water be employed. (*Idem.*, *C. R.*, 1859, **48.** 714.) Sparingly soluble in cold water. With 10 pts. of cold water it forms an opaque jelly, which becomes fluid at 99°. With 25 pts. of hot water it is completely dissolved; and it dissolves in still less water when this contains free alkali. All the stearate of potash is separated from this solution on the addition of chloride of potassium. (If chloride of sodium were added stearate of soda would separate out.) When 1 pt. of the normal salt is mixed with 1000 pts. of water an acid salt (No. 2) separates out. (Wittstein's *Handw.*) Permanent. Forms a gelatinous mass with water. Readily soluble in alcohol, and in ether which contains alcohol, though less so in cold than in hot. Almost entirely insoluble in pure ether. (Hardwick, *J. Ch. Soc.*, **2.** 235.) Soluble in 6⅔ pts. of boiling absolute alcohol. Soluble in 10 pts. of alcohol, of 0.821 sp. gr., at 66°. When the temperature of this solution is reduced to 55° it becomes turbid, and at 38° it solidifies. 100 pts. of boiling alcohol, of 0.794 sp. gr., dissolve 15 pts. of it, and 100 pts. of alcohol, of 0.821 sp. gr., dissolve 0.432 pt. of it at 10°. Very sparingly soluble in ether, even when this is boiling, with partial decomposition. [T.] Very sparingly soluble even in boiling ether. 100 pts. of boiling ether dissolve 0.16 pt. of it.

$C_{36}H_{35}KO_4, C_{36}H_{36}O_4$

II.) *bi.* Unacted upon by cold water, but is decomposed by boiling with much water.

Cold water exerts scarcely any action upon it. When 1 pt. of it is treated with 1000 pts. of boiling water a milky, cloudy emulsion is formed, which becomes fluid and transparent at 75°, and deposits flocks of No. 3 at 67°, the salt itself finally crystallizes out at from 59 @ 26°. Very sparingly soluble in cold, easily soluble in hot alcohol. The alcoholic solution has a neutral reaction, but when a solution which has been prepared in the cold is treated with a small quantity of water it acquires an acid reaction, and if a little water is added to a hot solution this acquires an alkaline reaction. Boiling ether removes the excess of acid, and leaves the normal salt. (Wittstein's *Handw.*) 100 pts. of boiling absolute alcohol dissolve 27 pts. of it, but at 24° they retain only 0.36 pt. of it: moreover, partial decomposition occurs, on account of the tendency of the alcohol to dissolve stearic acid in preference to the salt. The portion which remains in solution is consequently richer in stearic acid than that which separated out as the solution cooled.

Soluble in alcohol, without alteration. Ether dissolves out the second equivalent of acid, thus reducing it to the normal salt. (Chevreul, *C. R.*, 1859, **48.** 714.)

III.) *quadri?* Swells up in cold water. Decomposed by boiling alcohol.

STEARATE OF SILVER. Insoluble in water.
$C_{36}H_{35}AgO_4$ Easily soluble in ammonia-water. (Francis.)

STEARATE OF SODA.

$C_{36}H_{35}NaO_4$

I.) *normal.* Not sensibly changed when mixed with 10 times its weight of water. (Chevreul.) Scarcely at all soluble in cold, difficultly soluble in warm water. Easily soluble in warm alcohol, the solution gelatinizing on cooling. (Hardwick, *J. Ch. Soc.*, **2.** 235.) Sparingly soluble in cold water. More readily decomposed by hot water than the potash salt. With 10 pts. of boiling water it affords a thick, almost opaque, solution, viscous at 90°, and which when cooled to 62° becomes solid. With 50 pts. of hot water it gives a solution which may be filtered even at temperatures somewhat lower than 100°; when this solution is treated with 2000 pts. of water the acid salt is precipitated. With 20 pts. of hot alcohol it forms a perfect solution, from which it crystallizes on cooling. Unacted upon by boiling ether. (Wittstein's *Handw.*) Soluble in 20 pts. of boiling alcohol, of 0.821 sp. gr., and in 500 pts. of the same alcohol at 10°. Very slightly soluble in ether.

$C_{36}H_{35}NaO_4; C_{36}H_{36}O_4$

II.) *bi.* Insoluble in cold, soluble in hot water. Sparingly soluble in cold, easily soluble in hot alcohol.

Insoluble in ether. (W. Marcet.)

STEARATE OF STRONTIA.
$C_{36}H_{35}SrO_4$

STEARATE OF TREHALOSE.
$C_{72}H_{70}(C_{12}H_8O_6{}'')O_8$

STEARENE. *Vid.* Stearone.

STEARERIN. Soluble in 1000 pts. of alcohol, of 0.805 sp. gr., at 15°. Very slowly attacked by potash lye. (Chevreul.)

STEARIN.
(*Bibasic Stearate of Glyceryl.*)
$C_{42}H_{42}O_8 = C_6H_5O_3, 2HO, C_{36}H_{35}O_3$

Insoluble in glycerin. Very sparingly soluble in cold, more readily soluble in boiling ether. (Berthelot, *Ann. Ch. et Phys.*, (3.) **41.** 221.)

*Bi*STEARIN.
(*Monobasic Stearate of Glyceryl.*)
$C_{78}H_{78}O_{12} = C_6H_5O_8, HO, 2C_{36}H_{35}O_3 + 2Aq$

Soluble in boiling, but very sparingly soluble in cold ether.

*Tri*STEARIN
(*Normal Stearate of Glyceryl.*)
$C_{114}H_{110}O_{12} = C_6H_5O_3, 3C_{36}H_{35}O_3$

(probably identical with Natural Stearin). Soluble in boiling, but very sparingly soluble in cold ether. (Berthelot, *loc. cit.*)

Natural stearin is insoluble in water. Soluble in 6 @ 7 pts. of boiling, much less soluble in cold alcohol. It is very much more soluble in absolute alcohol than in spirit, the power of alcohol to dissolve the fats diminishing in an extremely rapid progression in proportion as it is diluted, or as its sp. gr. is increased from 0.795 to 0.821. Thus: 100 pts. of boiling alcohol of

0.7908 sp. gr. dissolved 100 pts. (and more) of mutton stearin.
0.7952 sp. gr. dissolved 16.07 pts. of mutton stearin.
0.805 " " 6.63 " "
0.821 " " 2.00 " "

(Chevreul, *Ann. Ch. et Phys.*, 1816, (2.) **2.** 361, *note.*)

100 pts. of boiling alcohol of
0.7952 sp. gr. dissolve 21.50 pts. of stearin from man.
" " 15.04 @ 16.07 " " the sheep.
" " 15.48 " " ox.
" " 17.65 @ 18.25 " " hog.
" " 36.00 " " goose.

(Chevreul, *Ann. Ch. et Phys.*, 1816, (2.) **2.** 364.)

Readily soluble in boiling, very much less soluble in cold ether. Soluble in 225 pts. of ether at 15°. Soluble in creosote. (Reichenbach.)

StearoChlorhydrin. $C_{42} H_{41} Cl O_6$ Insoluble in water. Soluble in ether. (Berthelot, *Ann. Ch. et Phys.*, (3.) **41.** 304.)

Stearone. (*Margarone. Stearene.*) $C_{70} H_{70} O_2$ Insoluble in water. Soluble in boiling alcohol. Very readily soluble in ether. (Rowney, *J. Ch. Soc.*, **6.** 98.)

Stearophanic Acid. *Vid.* Stearic Acid.

Stearophanin. *Vid.* Anamirtin.

Stib*di*Amyl. $(C_{10} H_{11})_2 Sb$, or $\left.\begin{matrix}(C_{10} H_{11})_2 Sb \\ (C_{10} H_{11})_2 Sb\end{matrix}\right\}$ Insoluble in water. Miscible in all proportions with alcohol, and ether. (Berlé.)

Stib*tri*Amyl. $Sb \left\{ (C_{10} H_{11})_3 \right.$ Insoluble in water. Sparingly soluble in absolute alcohol. Very easily soluble in ether. (Berlé.) Easily soluble in alcohol. (Cramer.)

Stib*tri*Ethyl. $Sb \left\{ (C_4 H_5)_3 \right.$ Insoluble in water. Readily soluble in alcohol, and ether. (Lœwig & Schweizer.)

"**StibEthylic Acid.**" *Vid.* Antimonite of StibEthyl.

StibEthylium. Not isolated.
$Sb \left\{ (C_4 H_5)_4 \right.$

Stib*tri*Methyl. $Sb \left\{ (C_2 H_3)_3 \right.$ Insoluble in water. Sparingly soluble in alcohol. Very easily soluble in ether. (Landolt.) The compounds of stibtrimethyl are in general very soluble in water, less soluble in alcohol, and almost insoluble in ether.

StibMethylium. Not isolated.
$Sb \left\{ (C_2 H_3)_4 \right.$

Stictic Acid (from *Sticta pulmonacea*). Much more difficultly soluble in absolute alcohol than cetraric acid.

Stictate of Potash. Much less soluble than cetrarate of potash. (Knop & Schnedermann.)

Stilbene. (*Picramyl. Hydride of Stilbyl.*) $C_{28} H_{12}''$ Insoluble in water. Very sparingly soluble in cold, more soluble in boiling alcohol. More soluble in ether than in alcohol. Soluble, with combination, in concentrated sulphuric acid. (Laurent.)

Stilbesic Acid. (*Suroxyde de Stilbèse.*) $C_{28} H_{10} O_7$ (?) Insoluble in water. Very sparingly soluble in alcohol, and ether. Soluble in aqueous and alcoholic solutions of caustic potash, and ammonia; from which it is precipitated on the addition of acids.

Stilbesate of Silver. $C_{28} H_8 Ag_2 O_7$ (?) Ppt., from alcohol.

Stilbic Acid. *Vid.* Benzilic Acid.

Stilbous Acid. (*Benzoate of Hydride of Benzoyl. Benzoate of Benzoyl. Suroxyde de Stilbène. Stilbinigesæure.*) Insoluble in cold, abundantly soluble in boiling alcohol. Readily soluble in ether. Insoluble in ammonia-water.

Stilbite of Potash. Easily soluble in water. Soluble in all proportions in alcohol. Insoluble in ether. (Laurent.)

StilbylAnilin. }
StilbylPhenylamin. } *Vid.* PhenylBenzolamin.

Stramonin (from *Datura Strammonium*). Insoluble in water. Difficultly soluble in spirit. More soluble in ether and the fixed and ethereal oils. Also in creosote and in concentrated sulphuric acid.

Strontia. *Vid.* Oxide of Strontium.

Strontium. Sr Many of the compounds of strontium are insoluble in water, but all of them, excepting sulphate of strontia, are soluble, with partial decomposition, in dilute nitric and chlorhydric acids.

Strychnic Acid. Readily soluble in water. Sparingly soluble in alcohol. (Rousseau.)

Strychnate of Potash. Soluble in water. Sparingly soluble, or insoluble, in weak alcohol.

Strychnine. $N_2 \left\{ C_{42} H_{22} O_4^{vi} \right.$ Permanent. Almost insoluble in water, since it requires 6667 pts. of water at 10°, and 2500 pts. of boiling water, to dissolve it.

Less soluble in water than either igasurin or brucin.

At ordinary temperatures it dissolves in water saturated with carbonic acid, but at 0° it is deposited again as such. (Langlois, *Ann. Ch. et Phys.*, (3.) **48.** 503.) Soluble in 7196.4 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, *in Canstatt's Jahresbericht, für* 1854, p. 76.) Soluble in 1200 pts. of alcohol, of 80%, at the ordinary temperature, and in 10 pts. of boiling alcohol of 80%. Insoluble in ether or in aqueous solutions of the caustic alkalies. Easily soluble in acids, with combination. It is not decomposed by cold dilute nitric acid, but when this solution is heated decomposition ensues. (Wittstein's *Handw.*) Strychnine is very sparingly soluble in the cold in neutral solvents. It dissolves in about 100 pts. of dilute alcohol. (Bouchardat, *Ann. Ch. et Phys.*, (3.) **9.** 228.) Readily soluble in common 70% spirit, but almost insoluble in absolute alcohol. Easily soluble in the essential oils. Insoluble in pure ether. Not sensibly soluble in the fatty oils.

Sparingly soluble in benzin. (Mansfield, *J. Ch. Soc.*, **1.** 262.) 100 pts. of chloroform dissolve 14.1 pts. of it. (Schlimpert, *Kopp & Will's J. B., für* 1859, p. 405.) 100 pts. of chloroform dissolve 20.16 pts. of it. (Michael Pettenkofer, *Kopp & Will's J. B., für* 1858, p. 363.) 100 pts. of olive-oil dissolve 1 pt. of it. (Pettenkofer, *Ibid.*)

Strychnine is insoluble in aqueous solutions of the fixed caustic or carbonated alkalies, but is soluble in ammonia-water. Easily soluble in acids, even weak and dilute, with combination. Most of its salts are easily soluble in water.

Strychnochrome. Sparingly soluble in water. Soluble in alcohol. Sparingly soluble in ether and in ethereal oils. (Pelletier & Caventou.)

Styphnic Acid. *Vid.* OxyPicric Acid.

Styracin. *Vid.* Cinnamate of Styracyl.

Styracol. }
Styracone. } *Vid.* Styrone.

Styracyl. (*Styryl.*) $C_{18} H_9$ Not isolated.

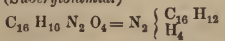
Styrol. (Isomeric, or identical, with Cinnamene.) $C_{16} H_8''$ Very slightly soluble in water, the undissolved portion of the styrol taking up at the same time a very small quantity of water. Miscible in all proportions with absolute alcohol, it dissolves with more and more difficulty in spirit according to the amount of water which this contains. Miscible in all proportions with ether. Soluble in wood-spirit, acetone, bisulphide of carbon, and in fatty and volatile oils. (Blyth & Hofmann.)

Styrone. Tolerably readily soluble in water. (*Styracone. Styracol. Styrax Alcohol. Peruvin. Zimmt Alcohol. Hydrate of Styracyl.*) $C_{18}H_{10}O_2 = C_{18}H_9O, HO$ Soluble in 90 @ 100 pts. of cold, and in 30 pts. of boiling water. (Simon.) Very soluble in alcohol, ether, styrol, naphtha, benzin, and the fatty and essential oils. Insoluble in hot nitric acid, by which it is only very slowly attacked. (Toel; Scharling.)

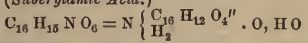
"**Styryl**"(of Kolbe). *Vid.* Styracyl. $C_{18}H_9$

Sub-carbonate (&c.) of *X*. See under Carbonate (&c.) of *X*.

Suberamid. Soluble in boiling, much less soluble in cold alcohol. (Laurent.) (*Suberylbiamid.*)


$C_{16}H_{10}N_2O_4 = N_2\left\{\begin{matrix}C_{16}H_{12}O_4''\\H_4\end{matrix}\right.$

Suberamic Acid. Soluble in boiling, less soluble in cold water. (*Suberylamic Acid.*)


$C_{16}H_{15}NO_6 = N\left\{\begin{matrix}C_{16}H_{12}O_4''\\H_2\end{matrix}\right. .O, HO$

Suberamate of Baryta. Soluble in water.

Suberamate of Silver. Ppt.

Suberanil? *Vid.* PhenylSuberimid.

SuberAnilid. *Vid.* PhenylSuberamid.

SuberAnilic Acid. *Vid.* PhenylSuberamic Acid.

Suberic Acid. Permanent. Sparingly soluble in cold, much more soluble in boiling water. (*Korksæure* (of the Germans). $C_{16}H_{14}O_8 = C_{16}H_{12}O_6, 2HO$

Soluble in 120 pts. of cold, and in 2 pts. of boiling water (Bouillon); in 50 pts. of cold water (Fourcroy); in 80 pts. of water at 13°, and in 38 pts. at 60°. (Chevreul, *Ann. de Chim.*, 1807, **62.** 328.)

Soluble in 100.1 pts. of water at 9°.
" 86.2 @ 95 " 12°.
" 5.0 " 84°.
" 1.87 " boiling.

Or, 100 pts. of water
at 9° dissolve 9.991 pts. of it.
" 12° " 1.054 @ 1.15 "
" 84° " 20.00 "
" 100° " 54.00 "

The boiling aqueous solution solidifies on cooling. (R. Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **32.** pp. 404–407.)

100 pts. of water at 18° dissolve 1.014 pts. of it; or 1 pt. is soluble in 98.6 pts. of water at 18°. Much more soluble in hot water. On cooling the hot solution much suberic acid separates, yet at 18° 100 pts. of water still contained 2.32 pts. of it. (Wirz, *Ann. Ch. u. Pharm.*, **104.** 271.) 100 pts. of water, at 15.56° dissolve 0.69 pt. of it, and at 100° 50 pts. (Ure's *Dict.*) It is much more soluble in water, but less soluble in ether than the acids above it in the series $C_nH_{n-2}O_8$. (Wirz, *loc. cit.*, p. 269.) Soluble in alcohol, especially if this is warm, in ether, and in the fatty and volatile oils.

Soluble in 4.56 pts. of absolute alcohol at 10°, and in 0.87 pt. at boiling; or, 100 pts. of absolute alcohol dissolve 21.9 pts. of it at 10°; and 114 pts. at boiling. (Brandes, *Schweigger's Journ.*, **32.** pp. 407, 408.) Easily soluble in alcohol; from a saturated alcoholic solution it is partially precipitated on the addition of water. Soluble, without alteration, in boiling nitric acid, from which it is deposited again on cooling, and more readily on the addition of water. (Chevreul, *Ann. de Chim.*, 1807, **62.** 332.)

Soluble in 10.11 pts. of ether at 4°.
" 7.80 " " 10°.
" 7.75 " " 20°.
" 6.00 " " 35° (boil.pt.)

Or, 100 pts. of ether
at 4° dissolve 9.8 pts. of it.
" 10° " 12.82 "
" 20° " 12.90 "
" 35° (boil. pt.) 16.60 "

(Brandes, *Schweigger's Journ.*, **32.** pp. 409, 410.)

Soluble in 19 pts. of oil of turpentine at 5°.
" 16 " " 12°.
" 11.5 " " 44°.
" 2.12 " " 120°.
" 1 " (boiling) 174.44°.

Or, 100 pts. of oil of turpentine
at 5° dissolve 5.2 pts. of it.
" 12° " 6.1 "
" 44° " 8.7 "
" 120° " 47 "
" 174.44° (boiling) 100 "

Both the boiling solution and that saturated at 120° solidify on cooling, to a viscid, waxy mass. These results were obtained by cooling down boiling saturated solutions; if the solutions had been prepared by agitating mixtures of the acid and oil of turpentine different results would have been obtained, the quantities of acid dissolved being much less in the latter case. With ether and alcohol also the acid exhibits a great tendency to form supersaturated solutions. [The solubilities in ether, given above, are probably, from this cause, too high; but the determination in alcohol, at 10°, was exempt from this source of error.] (Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **32.** pp. 410–412.) Also soluble in the fatty oils, especially when these are hot. (Brandes, *Schweigger's Journ.*, **32.** 412.)

The alkaline suberates and those of the alkaline earths are soluble in water.

Suberate of Alumina. Ppt.

Suberate of Ammonia. Deliquescent. Readily soluble in water. (Bouillon; Chevreul, *loc. cit.*, p. 331.) Very easily soluble in water. (Brandes, *Schweigger's Journ.*, **33.** 86.)

Suberate of Baryta. Somewhat soluble in water. (Chevreul, *loc. cit.*, p. 330.) Soluble in 59 pts. of water at 15°, and in 16.5 pts. at boiling. $C_{16}H_{12}Ba_2O_8$

Or, 100 pts. of water
at 15° dissolve 1.3 pts. of it, and
at 100° " 6 "

Or, the aqueous solution
saturated at 15° contains 1.67% of it, and
" 100° " 5.91% "

(Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **33.** pp. 89, 90.) [The figures given by Brandes for the experiment at 15°, and cited above, do not accord with his statement, that "66 grains of the solution made at that temperature gave 1 grain of residue"; these figures are, moreover, headed "suberic acid," instead of suberate of baryta.] Insoluble in water. (Laurent.)

Suberate of ChlorEthyl. $C_{16}H_{12}(C_4H_4Cl)_2O_8$

Suberate of Cobalt. Ppt.

Suberate of Copper. Very slightly soluble in water, but more soluble $C_{16}H_{12}Cu_2O_8$

than the silver salt. (Brandes, *Schweigger's Journ.*, **33.** 97.)

Suberate of Ethyl. $C_{16} H_{12} (C_4 H_5)_2 O_8$ Soluble in all proportions in alcohol, and ether. Soluble in cold concentrated sulphuric acid; the solution undergoing decomposition when heated. Scarcely at all acted upon by an aqueous solution of caustic potash. (Laurent.)

Suberate *of protoxide* of Iron. Insoluble in water. (Brandes, *Schweigger's Journ.*, **33.** 102.)

Suberate *of sesquioxide* of Iron. Insoluble in water. (Brandes.)

Suberate of Lead.

I.) *normal.* Water only dissolves a trace of it. $C_{16} H_{12} Pb_2 O_8$ (Brandes, *Schweigger's Journ.*, **33.** 101.) Completely insoluble in water or alcohol, even when these are warm. Soluble in dilute acetic acid. (Bromeis.)

II.) *basic.* Insoluble in water. $C_{16} H_{12} Pb_2 O_8, 2 Pb O$

Suberate of Lime. $C_{16} H_{12} Ca_2 O_8$ Soluble in 39 pts. of water at 14°, and in 9 pts. of boiling water.

Or, 100 pts. of water

at 14°	dissolve	2.6	pts. of it, and
at 100°	"	11.11	"

Or, the aqueous solution saturated

at 14°	contains	2.5%	of it, and
at 100°	"	10%	"

(R. Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **33.** pp 87, 88.) Appears to be soluble in alcohol.

Suberate of Magnesia. $C_{16} H_{12} Mg_2 O_8$ Somewhat hygroscopic. Easily soluble in water, being soluble in 1 pt. of water at 12°, and in much less water at higher temperatures. (Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **33.** 93.) Sparingly soluble, or insoluble, in alcohol. (Bouillon.)

Suberate of Manganese. Soluble in water. (Brandes, *loc. cit.*, p. 103.)

Suberate *of dinoxide* of Mercury. Insoluble in water. Decomposed when boiled with water or alcohol. Soluble in 2500 pts. of ether. Quickly soluble in hot, slowly soluble in cold nitric acid. (Harff.)

Suberate *of protoxide* of Mercury. $C_{16} H_{12} Hg_2 O_8$ Soluble in more than 2000 pts. of cold water, more readily soluble in boiling water. Nearly insoluble in alcohol. Soluble in 1200 pts. of ether. Soluble in chlorhydric and nitric acids. (Harff.)

Suberate of Mercur(*ous*)Ammonium. (?) ("Compound with $Hg_2 O + N H_3$") Insoluble in water, alcohol, or ether. Soluble in concentrated acetic acid, with decomposition. (Harff.)

Suberate of Mercur(*ic*)Ammonium. ("Compound with $Hg O + N H_3$") Insoluble in water, alcohol, or ether. Soluble in chlorhydric, and partially in nitric acid. Insoluble in cold, decomposed by hot concentrated sulphuric acid. (Harff.)

Suberate of Methyl. $C_{16} H_{12} (C_2 H_3)_2 O_8$ Insoluble, or but sparingly soluble, in water.

Suberate of Potash. Hygroscopic. As soluble in water as the soda salt. (Brandes, *Schweigger's Journ.*, **33.** 85.) Difficultly soluble in water. (Bouillon-La Grange.)

Suberate of Silver. $C_{16} H_{12} Ag_2 O_8$ Nearly insoluble in water. (Brandes, *Schweigger's Journ.*, **33.** 94.)

Suberate of Soda. $C_{16} H_{12} Na_2 O_8$ Somewhat hygroscopic. Soluble in 1 pt. of cold, and in much less hot water. (Brandes, *Schweigger's Journ.*, **33.** 83.) Soluble in alcohol. (Bouillon.)

Suberate of Strontia. $C_{16} H_{12} Sr_2 O_8$ Somewhat more soluble in water than the baryta salt. (Brandes, *loc. inf. cit.*)

Soluble in	21.2	pts. of water at	20°.
"	15.7	"	30°.
"	13.3	"	50°.
"	12.5	"	boiling

(Brandes.)

Or, 100 pts. of water

at 20°	dissolve	4.6	pts. of it.
" 30°	"	6.4	"
" 50°	"	7.5	"
" 100°	"	8.7	"

Or, the aqueous solution saturated

at 20°	contains	4.5%	of it.
" 30°	"	6%	"
" 50°	"	7%	"
" 100°	"	8%	"

(Brandes, *Schweigger's Journ. für Ch. u. Phys.*, 1821, **33.** pp. 91, 92.) Sparingly soluble, or insoluble, in alcohol.

Suberate *of protoxide* of Tin. Insoluble in water. Soluble in alcohol. (Bromeis.)

Suberate *of sesquioxide* of Uranium. Soluble in 300 pts. of boiling water. (Brandes, *Schweigger's Journ.*, **33.** 100.)

Suberate of Zinc. Ppt.

Suberone. *Vid.* Hydride of Suberyl.

Succinamic Acid. Not isolated.

$C_8 H_7 N O_8 = N \left\{ \begin{matrix} C_8 H_4 O_4'' \\ H_2 \end{matrix} \right. . O, H O$

Succinamate of Silver. $C_8 H_6 Ag N O_8$ Much more soluble in water than the compound of oxide of silver with succinimid ($C_8 H_4 Ag N O_4$).

Succinamid. (*Succinylbiamid.*) $C_8 H_8 N_2 O_4 = N_2 \left\{ \begin{matrix} C_8 H_4 O_4'' \\ H_4 \end{matrix} \right.$ Almost insoluble in cold, tolerably soluble in boiling water. (D'Arcet.) Soluble in 220 pts. water at 15°, and in 9 pts. of boiling water. Sparingly soluble in spirit. Insoluble in absolute alcohol, or in ether. (Fehling.)

*Bi*Succinamid. *Vid.* Succinimid.

*Tri*Succinamid. (*TriSuccinylbiamide.*) $C_{24} H_{12} N_2 O_{12} = N_2 \left\{ (C_8 H_4 O_4'')_3 \right.$ Decomposed by water, and alcohol. Soluble, under pressure, in warm anhydrous ether. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 162.)

SuccinAnil. *Vid.* PhenylSuccinimid.

SuccinAnilic Acid. *Vid.* PhenylSuccinamic Acid.

SuccinAnilid. *Vid.* *di*PhenylSuccinamid.

Succinic Acid(Anhydrous). $C_8 H_4 O_6 = C_8 H_4 O_4'' \left\} O_2 \right.$ It does not absorb water from the air. Less quickly soluble in water than the hydrated acid. Much more soluble in alcohol than in water. Very sparingly soluble in ether.

Succinic Acid. (*Bernsteinsæure* (of the Germans)). $C_8 H_6 O_8 = C_8 H_4 O_6, 2 H O$ Permanent. Much more soluble in warm than in cold water. Soluble in 5 pts. of water at 16° [10, as cited by Wirz], and in 2.2 pts. of water at 100° (Lecanu & Serbat); in 24 pts. of water at 11.1°, and in 2 pts. of water at 100° (Stockar de Neuforn, *De Succino,* [T.]); in 96 pts. of water at 10°. (Spielman, *Inst. Chem.*, § **12.** [T].) According to Neuforn the greater part of it crystallizes out of the hot solution as this becomes cold, but Roux maintains that the cooled solution retains more of it than cold water is capable of dissolving. (Morveau, *Encyc. Méthod.*, *Chim.*, **1.** 72 [T.].) Soluble in 25 pts. of cold, and in 3 pts. of boiling water; the saturated cold solution containing 3.85% of it, and the saturated boiling solution 25%. (Berzelius's *Lehrb.*) Soluble in 20 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76.) 100 pts. of water dissolve 4 pts. of it at 15.56°, and 50 pts. at 100° (Ure's *Dict.*); 20 pts. at 16, and 46 pts. at 100°. (Lecanu & Serbat.) An aqueous solution of 1.01 sp. gr. contains 2.78% of the acid, one of 1.04 sp. gr. contains 10.82% of it. (Richter.)

Soluble in 3 pts. of cold, and 1.5 pts. of boiling alcohol. Also soluble in ether. (Wittstein's *Handw.*) Soluble in 1.356 pts. of boiling highly rectified spirit, crystallizing out again in part as the solution cools. (Wenzel, in his *Verwandtschaft*, p. 305 [T].) Less soluble in alcohol than in water, and scarcely at all soluble in ether. (D'Arcet.) Only slightly soluble in oil of turpentine, even when this is boiling. (Lecanu & Serbat.) Insoluble in caoutchin. (Himly.) Soluble in warm sulphuric and nitric acids, apparently without decomposition. Chlorhydric acid has but little action on it in the cold, but when heated with it the whole coagulates to a jelly. (Thomson's *System.*)

Most succinates are soluble in water; those insoluble in water are soluble in an aqueous solution of acetate of potash, hence a mixture of succinate of potash and acetate of potash cannot precipitate any metallic salt. (Lecanu & Serbat.) Also soluble in succinic acid.

On the addition of a small portion of a ferment to dilute aqueous solutions of the alkaline succinates, exposed to the air in a warm place, decomposition rapidly ensues, the salt being finally converted into a carbonate. (Buchner, Jr., *Ann. Ch. u. Pharm.*, 1851, **78.** 207.)

Succinate of Ammolin (of Unverdorben). Very readily soluble in water, and alcohol. Insoluble in ether.

Succinate of Alumina. There are two salts, one of which is soluble, the other insoluble in water. (Wenzel.)

Succinate of Ammonia.

I.) *normal.* Loses ammonia when exposed to the air. Readily soluble in water (Dœpping), the solution undergoing partial decomposition, in the course of a considerable time. (Horst.) When treated with boiling water some ammonia is evolved, and the solution obtained exhibits an acid reaction. (Emmet, *Am. J. Sci.*, (1.) **18.** pp. 255, 256.) Readily soluble in alcohol, and ether.

$C_8 H_4 (N H_4)_2 O_8$

Soluble in boiling creosote. (Reichenbach.)

II.) *acid.* Permanent. Readily soluble in water, and alcohol. (Dœpping.)

$C_8 H_5 (N H_4) O_8$

Succinate of Anilin. Soluble in water, and alcohol. (Gerhardt.)

Succinate of Antimony. Soluble in water. [Y.]

Succinate of Baryta.

I.) *normal.* Sparingly soluble in water or succinic acid. More readily soluble in acetic acid, and still more readily in dilute nitric or chlorhydric acid. Insoluble in alcohol or ammonia-water. (Dœpping.)

$C_8 H_4 Ba_2 O_8$

Succinate of Benzol. Soluble in ether, but the solution is decomposed by evaporation. Decomposed by a dilute aqueous solution of caustic soda. (Wicke.)

(*Succinate of Benzol Ether.*)
$C_{22} H_{10} O_8 = C_8 H_4 (C_{14} H_6'') O_8$

Succinate of Bismuth. There are two salts, the one soluble in water, the other insoluble. (Wenzel.)

$C_{24} H_{12} (Bi''')_2 O_{24}$

Succinate of Cadmium.

I.) *normal.* Insoluble in water or ordinary alcohol. Very sparingly soluble in succinic acid. (Schiff, *Ann. Ch. u. Pharm.*, **104.** 326.)

$C_8 H_4 Cd_2 O_8$

II.) *acid?* Readily soluble in water. Decomposed by alcohol to a compound soluble in alcohol, and another easily soluble in water. (John.)

Succinate *of protoxide* of Cerium. Sparingly soluble in water, even when this is acidulated with succinic acid. Readily soluble in the stronger acids. (Berzelius.)

$C_8 H_4 Ce_2 O_8$

Succinate of Cetyl. Sparingly soluble in alcohol, more easily soluble in a mixture of alcohol and ether, and still more easily in pure ether.

$C_8 H_4 (C_{32} H_{33}) O_8$

Succinate *of protoxide* of Chromium. Ppt.

$C_8 H_4 Cr_2 O_8 + 2 Aq$

Succinate *of sesquioxide* of Chromium. Insoluble in water. Soluble in acetic acid. (Hayes.) Insoluble in alcohol, soluble in an aqueous solution of succinate of soda. (Berlin.)

Succinate of Cobalt. Difficultly soluble in water. (Berzelius; Macaire-Princep.)

$C_8 H_4 Co_2 O_8$

Succinate of Copper. Difficultly soluble in water or succinic acid, more easily soluble in acetic acid. Insoluble in alcohol (Dœpping), or ether. (Unverdorben.)

$C_8 H_4 Cu_2 O_8$

Succinate of Ethyl. Somewhat soluble in water. Soluble in all proportions in alcohol. Also soluble in ether. (Fehling.)

$C_8 H_4 (C_4 H_5)_2 O_8$

Succinate of Ethyl *perchloré*. *Vid. quadri*-ChloroSuccinate of perChlorEthyl.

Succinate of EthylSalicyl. *Vid.* Salicylate of EthylSuccinyl.

Succinate of Glucina. Difficultly soluble in water.

$Gl_2 O_3, 3 H O, 3 C_8 H_4 O_8$

Succinate *of protoxide* of Iron. Difficultly soluble in water, somewhat more readily soluble in succinic acid. (Berzelius.) Partially soluble in ammonia-water and in aqueous solutions of ammoniacal salts. (Wittstein.)

$C_8 H_4 Fe_2 O_8$

Succinate *of sesquioxide* of Iron.

I.) *polybasic.* Several precipitates.

$9 \text{ to } 15 Fe_2 O_3, C_8 H_4 O_8$

II.) Insoluble in cold, sparingly soluble in hot water. Easily soluble in mineral acids. Caustic ammonia removes a portion of the acid, insoluble

$Fe_2 O_3, H O, 2 C_8 H_4 O_8$

basic salts being produced. Insoluble in cold, very dilute succinic acid, more readily soluble, however, in a warm solution. It was formerly erroneously thought that this precipitate was decomposed by hot water into an insoluble basic and a soluble acid salt. (Fresenius, *Quant.*, p. 14.) Insoluble in water. Readily soluble in dilute mineral acids. (Bucholz.) Very sparingly soluble in boiling water. When recently precipitated it is tolerably soluble in boiling succinic acid. Slowly soluble in cold, readily in hot acetic acid. (Dœpping.) Soluble in an excess of a solution of caustic ammonia or of soda, being reprecipitated after the lapse of some hours. (Winckler.) Insoluble in an aqueous solution of chloride of ammonium, or in alcohol. (Berzelius, *Lehrb.*, 3. 631.) It is not precipitated from solutions which contain citrate of soda. (Spiller.)

Succinate of Lead.

I.) *normal.* $C_8H_4Pb_2O_8$ Very sparingly soluble in water, acetic acid, or succinic acid, even when hot. Insoluble in alcohol. (Dœpping.) Soluble in an aqueous solution of normal acetate of lead. (Winckler.) Easily soluble in nitric acid.

II.) $2\,C_8H_4Pb_2O_8;\ 2\,PbO$ Insoluble in water or alcohol. Soluble in an aqueous solution of caustic potash. (Dœpping.)

III.) IV.) } Fehling's basic salts.

V.) *hexa.* $C_8H_4Pb_2O_8,\ 4\,PbO$ Very sparingly soluble in water. (Berzelius.) Insoluble in alcohol. Readily soluble in dilute nitric acid and in potash-lye. (Dœpping.)

Succinate of Lime.

I.) *normal.* $C_8H_4Ca_2O_8 + 2\,Aq\ \&\ 6\,Aq$ Permanent. Sparingly soluble in water, and acetic acid; more readily soluble in succinic acid, and very easily soluble in nitric and chlorhydric acid. Insoluble in alcohol. (Dœpping.)

II.) *acid.* $C_8H_5CaO_8 + 2\,Aq$ Permanent. Sparingly soluble in water, though more readily than the normal salt. Hot alcohol decomposes it, dissolving out half of the acid. (Dœpping.)

Succinate of Lithia.

I.) *normal.* $C_8H_4Li_2O_8$ Very deliquescent and soluble in water. (Scheibler; Troost.) Insoluble in alcohol, or ether.

Succinate of Magnesia.

I.) *normal.* $C_8H_4Mg_2O_8 + 12\,Aq$ Permanent. Readily soluble in water. Insoluble in alcohol. (Dœpping.)

Fehling has observed salts containing different amounts of water of crystallization which are more slowly soluble than this one.

II.) *hexa.* Ppt. Insoluble in acetic acid.
$C_8H_4Mg_2O_8,\ 4\,MgO + 3\,Aq$

Succinate of Magnesia & of Potash. $C_8H_4MgKO_8 + 5\,Aq$ Permanent. (The anhydrous salt is deliquescent.) Readily soluble in water. Sparingly soluble in spirit. (Dœpping.)

Succinate of Manganese. Permanent. $C_8H_4Mn_2O_8 + 8\,Aq$ Soluble in 10 pts. of water at 19° [13°]. Insoluble in alcohol. (John.)

Succinate *of dinoxide* **of Mercury** (Hg_2O). $C_8H_4Hg_4O_8$ Somewhat soluble in pure water. Insoluble in water which contains succinate of soda. (H. Rose.) Insoluble in water. 1000 pts. of alcohol dissolve 0.75 pt. of it. (Harff, in *Berzelius's Lehrb.*) Insoluble in water, alcohol, or succinic acid. Readily soluble in nitric acid. (Dœpping.)

Succinate *of protoxide* **of Mercury.** Sparingly soluble in water. Insoluble in alcohol.

Succinate of Methyl. $C_8H_4(C_2H_3)_2O_8$ Scarcely at all soluble in water. (Fehling.) Soluble in alcohol, and ether.

Succinate of MethylSalicyl. *Vid.* Salicylate of Methyl & of Succinyl.

Succinate *of protoxide* **of Molybdenum.** Insoluble in water. Slightly soluble in succinic acid. (Berzelius's *Lehrb.*)

Succinate *of binoxide* **of Molybdenum.** $C_8H_4Mo''O_8$ Ppt. Soluble in succinic acid. (Dumas, *Tr.*)

Succinate of Molybdic Acid. Soluble in water. Decomposed by alcohol. (Berzelius's *Lehrb.*)

Succinate of Nickel. $C_8H_4Ni_2O_8 + 8\,Aq$ Soluble in water, acetic acid, and ammonia-water. Insoluble in alcohol. (Dœpping.)

Succinate of Potash.

I.) *normal.*

a $= C_8H_4K_2O_8 + Aq$ Permanent. Easily soluble in water, and alcohol.

b $= C_8H_4K_2O_8 + 4\,Aq$ Deliquescent. (Dœpping; Lecanu & Serbat.) Very soluble in water. Soluble in spirit. Insoluble in ether. (Dœpping.)

II.) *acid.* $C_8H_5KO_8 + 4\,Aq$ Efflorescent. Readily soluble in water, and alcohol. (Dœpping.)

III.) *peracid.*
$C_8H_5KO_8,\ C_8H_6O_8 + 3\,Aq$

Succinate of Potash & of Uranium. $C_8H_4K_2O_8;\ 2(2\,Ur_2O_3,\ C_8H_4O_6)$ Insoluble in water, but is gradually decomposed by long-continued washing with warm water. Insoluble in alcohol.

Succinate *of dinoxide* **of Silver.** $C_8H_4Ag_4O_8$ Insoluble in water. (Wœhler.)

Succinate *of protoxide* **of Silver.** $C_8H_4Ag_2O_8$ Very slowly soluble in water or acetic acid. Readily soluble in dilute nitric acid, and in ammonia-water. Insoluble in alcohol. (Dœpping.)

Succinate of Soda.

I.) *normal.* $C_8H_4Na_2O_8 + 12\,Aq$ Slightly efflorescent. Readily soluble in water, especially when this is hot. (Lecanu & Serbat.) Soluble in spirit. (Dœpping.)

II.) *acid.* Readily soluble in water, and spirit.
$C_8H_5NaO_8 + 4\,Aq\ \&\ 6\,Aq$ (Dœpping.)

Succinate of Soda & of Uranium. $C_8H_4Na_2O_8;\ (2\,Ur_2O_3,\ C_8H_4O_6)$ Insoluble in water, or alcohol. Slowly decomposed when washed with water.

Succinate of Solanin. Readily soluble in water.

Succinate of StibEthylium. Very easily soluble in water, and alcohol.

Succinate of Strontia.

I.) *normal.* Sparingly soluble in water [though much more soluble than the baryta salt], more readily in succinic and acetic acids. [Soluble in the acids generally (H. Rose, *Tr.*)] Insoluble in alcohol. (Dœpping.)

SUCCINATE OF THORIA. $C_8H_4Th_2O_8$ Ppt. Succinic acid dissolves only a trace of it. (Berzelius, *Pogg. Ann.*, 1829, **16.** 414.)

SUCCINATE *of protoxide* OF TIN. Insoluble in water. Soluble in chlorhydric acid. Wenzel obtained an ill-defined soluble compound also.

SUCCINATE *of binoxide* OF TIN. Insoluble in water.

SUCCINATE *of protoxide* OF URANIUM. Ppt. (Berzelius, *Lehrb.*)

SUCCINATE *of sesquioxide* OF URANIUM.

I.) $2\,Ur_2O_3, C_8H_6O_8$ Very sparingly soluble in water. Partially decomposed by boiling water. Insoluble in alcohol. (Richter.)

II.) *basic.* Insoluble in water.

SUCCINATE OF UREA. $2\,C_4H_4N_2O_2, C_8H_6O_8$ Rather more soluble in water than the oxalate of urea. (Hlasiwetz.)

SUCCINATE *of binoxide* OF VANADIUM.

SUCCINATE OF YTTRIA. $C_8H_4Yr_2O_8 + 12\,Aq$ Very sparingly soluble in cold, readily soluble in warm water. (Berlin.)

SUCCINATE OF ZINC. $C_8H_4Zn_2O_8$ Very slowly soluble in water, and succinic acid. Readily soluble in mineral acids, in acetic acid, and in aqueous solutions of caustic potash, and ammonia.

Insoluble in alcohol. (Dœpping.)

SUCCINATE OF ZIRCONIA. Insoluble in water.

SUCCINIC ANHYDRIDE. *Vid.* Succinic Acid (Anhydrous).

SUCCINIC ETHER. *Vid.* Succinate of Ethyl.

SUCCINIMID. Abundantly soluble in water.
(*BiSuccinamid. Succinylamid.*)
$C_8H_5NO_4 + 2\,Aq = N\left\{\begin{matrix} C_8H_4O_4'' \\ H \end{matrix}\right. + 2\,Aq$
Tolerably soluble in alcohol. Sparingly soluble in ether. (D'Arcet.)

SUCCINIMID with ARGENTAMMONIUM.
$N\left\{\begin{matrix} C_8H_4O_4'' \\ (NH_3Ag) \end{matrix}\right.$

SUCCINIMID with LEAD. $3\,C_8H_5NO_4 ; 4\,PbO + 3\,Aq$ Hygroscopic. Soluble in water. Insoluble in alcohol. (Fehling.)

SUCCINIMID with MERCURY. $N\left\{\begin{matrix} C_8H_4O_4'' \\ Hg \end{matrix}\right.$ Soluble in water. (Dessaignes.)

SUCCINIMID with SILVER. $N\left\{\begin{matrix} C_8H_4O_4'' \\ Ag \end{matrix}\right.$ Sparingly soluble in cold, easily soluble in boiling water, and alcohol. Soluble in all proportions in ammonia-water. Decomposed by long-continued boiling with water. (Laurent & Gerhardt.)

SUCCININ. $C_{14}H_{10}O_{10}$ Insoluble in water, alcohol, ether, or bisulphide of carbon. Slowly soluble in boiling water, and alcohol. Slowly soluble in cold alkalies, and more quickly when heated. (Van Bemmelen.)

SUCCINYL*bi*AMID. *Vid.* Succinamid.

SUCCINYLARGENT*bi*AMID.
$C_8H_7N_2AgO_4 = N_2\left\{\begin{matrix} C_8H_4O_4'' \\ Ag \\ H_3 \end{matrix}\right.$

SUCCINYLSULPHOPHENYLAMIC ACID. *Vid.* SulphoPhenylSuccinylamic Acid.

SUCCINYLSULPHOPHENYLAMID. (*SulphoPhenylSuccinamid. SulphoSuccinanil.*)
$C_{20}H_9NS_2O_8 = N\left\{\begin{matrix} C_{12}H_5S_2O_4 \\ C_8H_4O_4'' \end{matrix}\right.$
Sparingly soluble in boiling, less soluble in cold water, alcohol, and ether. Not immediately soluble in solution of caustic ammonia. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 157.)

SUCCINYL*di*SULPHOPHENYL*di*BENZOYL*bi*AMID. (*SuccinyldiSulphoPhenylBenzamid.*)
$C_{60}H_{24}N_2S_4O_{16} = N_2\left\{\begin{matrix} C_8H_4O_4 \\ (C_{14}H_5O_2)_2 \\ (C_{12}H_5S_2O_4)_2 \end{matrix}\right.$
There are two modifications, one of which is crystalline, the other viscous. When heated under pressure with ether both modifications dissolve easily. But at the ordinary atmospheric pressure the crystalline modification is difficultly soluble in ether, while the viscous modification dissolves in all proportions in ether. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 161.)

SUCCISTERENE. (White substance from the distillation of amber.) $C_{24}H_8$ Insoluble in water. Scarcely at all soluble in cold, more readily soluble in hot alcohol or ether. Soluble in the fixed and volatile oils. Unacted upon by alkaline solutions, or by cold mineral acids; but is soluble in warm concentrated sulphuric acid, with subsequent decomposition. It appears to be a little more soluble in alcohol, and ether, than its isomer idrialin. The presence of a small quantity of the yellow substance obtained from amber (chrysene?) renders it much less soluble in alcohol, and ether. (Pelletier & Walter, *Ann. Ch. et Phys.*, (3.) **9.** 96.)

SUCRATE OF *X.* *Vid. infra*, under SUGAR, p. 573.

SUGAR. (*Cane Sugar. Palm Sugar. Beet Sugar. Maple Sugar. &c.*) $C_{12}H_{11}O_{11}$ Permanent. Soluble in ⅓ its own weight of cold water, and in all proportions in water at high temperatures, such as are obtained by heating strong solutions of sugar, but when kept for a long time at temperatures near ebullition, it is converted into molasses, or uncrystallizable sugar. (*Vid. inf.*) At 100° water takes up 5 times its own weight of sugar, of which it loses 3 pts. by crystallization when the solution is cooled. (Dubrunfaut.) When a very concentrated solution of sugar (*viscid syrup*) is allowed to cool, it solidifies, as barley candy.

At 15.5° a saturated aqueous solution of sugar is composed of 2 pts. of sugar and 1 pt. of water; at 79.4° of about 4 pts. of sugar and 1 pt. of water; and at 100°, of 5 pts. of sugar and 1 pt. of water. (McCulloh, *Report, U. S. Senate Document*, No. 209, 29th Congress, 2d Session.) The aqueous solution saturated at 15° is of 1.345082 sp. gr., and contains dissolved in every 100 pts. of water at least 209.738 pts. of sugar. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) From a hot solution containing 5 pts. of sugar to 1 pt. of water, ⅗ of the sugar crystallizes out on cooling. (Henry.)

Beet-root-sugar crystals are somewhat more *slowly* soluble in water than those of cane-sugar, they are also more readily obtained of large size than the latter. Probably the other varieties, as maple or palm sugar, have also slightly different degrees of solubility.

Percentage of Sugar in aqueous Solutions.

Sp Gr. (at 17.5°)	Percent of Sugar.	Sp. Gr. (at 17.5°)	Percent of Sugar.
1.0035	1	1.1582	36
1.0070	2	1.1631	37
1.0106	3	1.1681	38
1.0143	4	1.1731	39
1.0179	5	1.1781	40
1.0215	6	1.1832	41
1.0254	7	1.1883	42
1.0291	8	1.1935	43
1.0328	9	1.1989	44
1.0367	10	1.2043	45
1.0410	11	1.2098	46
1.0456	12	1.2153	47
1.0504	13	1.2209	48
1.0552	14	1.2265	49
1.0600	15	1.2322	50
1.0647	16	1.2378	51
1.0693	17	1.2434	52
1.0738	18	1.2490	53
1.0784	19	1.2546	54
1.0830	20	1.2602	55
1.0875	21	1.2658	56
1.0920	22	1.2714	57
1.0965	23	1.2770	58
1.1010	24	1.2826	59
1.1056	25	1.2882	60
1.1103	26	1.2938	61
1.1150	27	1.2994	62
1.1197	28	1.3050	63
1.1245	29	1.3105	64
1.1293	30	1.3160	65
1.1340	31	1.3215	66
1.1388	32	1.3270	67
1.1436	33	1.3324	68
1.1484	34	1.3377	69
1.1533	35	1.3430	70

(Niemann, *Ann. der Pharm.*, 1832, **2.** 340.)

Sp. Gr. (at 17.5°)	Percent of Sugar.	Sp. Gr. (at 17.5°)	Percent of Sugar.
0	1.0000	32	1.1391
1	1.0040	33	1.1440
2	1.0080	34	1.1490
3	1.0120	35	1.1540
4	1.0160	36	1.1590
5	1.0200	37	1.1641
6	1.0240	38	1.1692
7	1.0281	39	1.1743
8	1.0322	40	1.1794
9	1.0363	41	1.1846
10	1.0404	42	1.1898
11	1.0446	43	1.1951
12	1.0488	44	1.2004
13	1.0530	45	1.2057
14	1.0572	46	1.2111
15	1.0614	47	1.2165
16	1.0657	48	1.2219
17	1.0700	49	1.2274
18	1.0744	50	1.2329
19	1.0788	51	1.2385
20	1.0832	52	1.2441
21	1.0877	53	1.2497
22	1.0922	54	1.2553
23	1.0967	55	1.2610
24	1.1013	56	1.2667
25	1.1059	57	1.2725
26	1.1106	58	1.2783
27	1.1153	59	1.2841
28	1.1200	60	1.2900
29	1.1247	61	1.2959
30	1.1295	62	1.3019
31	1.1343	63	1.3079
64	1.3139	71	1.3570
65	1.3190	72	1.3633
66	1.3260	73	1.3696
67	1.3321	74	1.3760
68	1.3383	75	1.3824
69	1.3445	75.35	1.3847
70	1.3507		

(Balling, in his *Gährungs-chemie*, Prag, 1854, **1.** table II. to page 118; compare Brix, *Verhandlungen des Vereins zur Beförderung des Gewerbefleisses, in Preussen*, 1854, p. 132, and Gerlach, *Sp. Gew. der Salzlösungen*, 1859, p. 43.)

An aqueous solution at 15.5° (*water at* 15.5° = 1).

Of Sp. Gr. (according to Steinheil).	Contains Percent of Sugar.	Of Sp. Gr. (according to Balling).
1.000000	0	1.00000
1.004066	1	1.00438
1.008182	2	1.00839
1.012345	3	1.01239
1.016554	4	1.01639
1.020807	5	1.02040
1.025100	6	1.02441
1.029434	7	1.02851
1.033807	8	1.03261
1.038214	9	1.03673
1.042652	10	1.04083
1.047123	11	1.04504
1.051618	12	1.04925
1.056133	13	1.05346
1.060669	14	1.05767
1.065219	15	1.06188
1.069778	16	1.06621
1.074343	17	1.07054
1.078913	18	1.07496
1.083483	19	1.07940
1.088053	20	1.08384

(Steinheil, in his *Gehaltprobe für Biere, München*, 1847; Balling, in his *Gährungs-chemie*, Prag, 1854, **1.** table II. to page 118; both cited by Pohl, *loc. cit.*, p. 18, who has also reduced Balling's table to the temperature of 15.5°, as above.)

Sp. Gr. (at 15°*)	Percent of Sugar	Sp. Gr. (at 15°)	Percent of Sugar.
1.00000	0	1.04718	11
1.00412	1	1.05167	12
1.00824	2	1.05619	13
1.01240	3	1.06072	14
1.01661	4	1.06527	15
1.02086	5	1.06983	16
1.02515	6	1.07440	17
1.02949	7	1.07897	18
1.03386	8	1.08354	19
1.03827	9	1.08811	20
1.04271	10		

(Pohl, *Denkschriften der Wiener Akad. math.-nat. Klasse*, 1851, vol. **2.** p. 25 of the memoir.) In his very elaborate memoir Pohl also gives tables of corrections for temperature, expansion of instruments employed, &c., &c.

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* Sp. Gr. of water at 15° = 1.

An aqueous solution containing pts. of Sugar	pts. of Water	Is of Sp. Gr. (at 17.5°).
1	10	1.036
1	9	1.040
1	8	1.045
1	7	1.051
1	6	1.057
1	5	1.068
1	4	1.080
1	3	1.105
1	2	1.143
1	1	1.230
2	1	1.332

(R. Brandes & G. Reich, *Brandes's Archiv.*, 1827, (1.) **22.** 70.)

A Mixture of kilogrammes of Sugar.	Water.	Is of Sp. Gr. (at 15°)	Contains Sugar In 100 Litres Kilogs.	In 100 Kilogs. Kilogs.
100	50	1345.29	89.68	66.6
"	60	1322.31	82.64	62.5
"	70	1297.93	76.35	58.8
"	80	1281.13	71.17	55.5
"	90	1266.66	66.66	52.6
"	100	1257.86	62.88	50
"	120	1222.22	55.55	45.4
"	140	1200.	50.	41.6
"	160	1187.21	45.66	38.4
"	180	1176.47	42.	35.7
"	200	1170.72	39.	33.3
"	250	1147.54	32.7	28.5
"	350	1111.11	24.6	22.2
"	450	1089.10	19.8	18.1
"	550	1074.38	16.5	15.3
"	650	1063.83	14.18	13.3
"	750	1055.90	12.42	11.7
"	945	1045.	10.	9.5
"	1445	1030.	6.66	6.4
"	1945	1022.05	5.	4.8
"	2445	1018.	4.	3.3
"	2945	1015.	3.33	3.2

(Payen, in *Dumas's Traité*, Liége Edition, **2.** 197.)

A Solution of Sugar of Sp. Gr.	Contains, in 1000 pts. of Water, pts. of Sugar.
1010.1	25.
1020.2	50.
1030.2	75.
1040.6	100.
1051.	125.
1061.8	150.
1072.9	175.
1083.8	200.
1095.2	225.
1106.7	250.

(Graham, Hofmann, & Redwood, *J. Ch. Soc.*, **5.** 231. These authors remark, that "the tables of sp. gr. constructed by Mr. Bate have been verified and are considered entirely trustworthy. The table here given, however, is by ourselves." When yeast is added to solutions of cane-sugar the sp. gr. of the solution is at first increased, owing to the change of the sugar into starch-sugar. When fermentation commences, however, the sp. gr. of the solution soon falls. When cane-sugar is converted into starch-sugar by the action of acids, a similar increase of sp. gr. occurs. (*Ibid.*) When 20 grms. of cane-sugar are dissolved in 100 cc. of water, the temperature falls half a degree. (Dubrunfaut.) When 560 grms. of cane-sugar are dissolved in 1100 grms. of water at 16.62° the temperature falls to 15.5°. (Pohl.)

Soluble in 80 pts. of boiling absolute alcohol, separating out again almost completely as the solution cools. (Pfaff.) Soluble in 4 pts. of strong boiling alcohol. (Wenzel, in his *Verwandtschaft*, p. 300 [T.]). Soluble in 24.5 pts. of alcohol of 0.83 sp. gr. Much more soluble in hot than in cold ordinary alcohol, and still more soluble in weaker spirit, the more readily in proportion as this is dilute and warm, but always less soluble in spirit than in water.

Insoluble in ether. Ether precipitates it from the alcoholic solution. (Dœbereiner.) More soluble in an aqueous solution of borax than in pure water. (Stürenberg.)

When boiled with water during 15 @ 20 hours cane-sugar begins to undergo change, being converted into uncrystallizable sugar and grape-sugar. (Pelouze & Malaguti, 1832, cited by M., *Ann. Ch. et Phys.*, 1835, (2.) **59.** 416.) A solution of cane-sugar in pure water may be preserved for weeks in closed vessels without undergoing any change; but if a solution of about 10° B. is exposed to the air, being protected from dust the while, traces of altered sugar will be found after 3 days, and the amount of the latter increases from day to day. This change does not depend upon organic matter from the air, as was formerly held, for solutions of pure sugar being brought into intimate contact with the air alter very quickly: in an experiment, where the solution of sugar of 10° B. was caused to flow over bits of glass, in a cylinder open at both ends, at 18.75°, it was found that traces of sugar were altered at the end of 6 hours, the change then going on so rapidly that scarcely any crystallizable sugar remained after 36 hours. (Hochstetter, *J. pr. Ch.*, 1843, **29.** pp. 22, 40.) In case the nitrogenized matter of beet-juice (or of the sugar-cane) is present in the sugar solution of the last experiment, all the cane-sugar is changed in the course of a few hours. (*Ibid.*, pp. 32, 40.) When its aqueous solution is persistently boiled or exposed to a temperature higher than that of boiling water, cane-sugar is decomposed, as has been noticed by several observers, and loses its power of crystallizing. This alteration by water and warmth, nevertheless, takes place with exceeding slowness; it being necessary to boil the sugar solution during several hours in order to clearly detect any change. A solution of pure sugar of 25° B. was boiled in an open dish, in one instance during 1 hour, in another 1½ hours, and in another 2 hours, the evaporated water being added only when the temperature of the boiling liquid had risen to 110° @ 112°: no coloration of the liquid occurred in either case, and an abundant crystallization of cane-sugar was obtained from all three; decomposition had, nevertheless, begun, traces of uncrystallizable sugar being detected on testing. This experiment having been frequently repeated always gave the same result. In case the sugar solution is boiled in a flask a larger amount of sugar is changed than would be altered in the same space of time in the dish. This may perhaps depend upon the condensed water which flows back from the neck of the flask, and may contain traces of formic acid. This may also be the explanation of Soubeiran's results, he having found a considerable change after 2 @ 3 hours' boiling, and a strong acid reaction. It is very easy, in any event, to perceive that the decomposition of the sugar proceeds more rapidly after long-continued boiling than is the case at the beginning of the experiment; and in proportion to the formation of products of decomposition, so much the more is the latter accelerated. Cane-sugar is changed much more rapidly by boiling, if air be passed through the hot solution. A current of air being drawn through a boiling sugar solution of 15° B., contained in a flask, the liquid became considerably colored in less than 1½ hours, and was found to contain no inconsiderable amount of altered sugar, the change being materially greater than when no air was passed through the boiling liquor. (Hochstetter, *J. pr. Ch.*, 1843, **29**. pp. 23 – 26, 40.)

An aqueous solution of cane-sugar partially loses its dextro-rotatory power at the common temperature by standing; finally losing it entirely, and acquiring a rotatory power towards the left, the cane-sugar being converted into inverse sugar. A solution being heated for 3 hours upon the water-bath lost 3.5 @ 4% of its rotatory power. (Maumené.) On boiling an aqueous solution of sugar, the water which evaporates being replaced, its dextro-rotatory power becomes weaker and weaker, and is at last completely lost. At this point and until the subsequent lævo-rotatory power has not arrived at its maximum, the liquor still contains unaltered cane-sugar, for the addition of acids still increases the lævo-rotation. When the transformation is complete, for which 114 hours' boiling is necessary, longer boiling causes the formation of formic and acetic acids, and a dark coloration. (Soubeiran.) No ordinary (dextro-) glucose is formed when an aqueous solution of cane-sugar is boiled, but after 60 hours' boiling a peculiar non-crystallizable sugar. (Bouchardat.) The formation of ordinary (dextro-) glucose and lævo-glucose unquestionably occurs simultaneously in the decomposition of aqueous solutions of cane-sugar. (Dubrunfaut, Maumené, Béchamp.) This transformation of cane-sugar takes place at 90° @ 100°. (Thénard.)

When warmed with dilute acids, or when left to itself, an aqueous solution of cane-sugar loses its dextro-rotatory power and acquires a lævo-rotatory power. (Biot.) When boiled, or even when heated to 95°, with dilute acids, cane-sugar is converted into grape-sugar; the latter being subsequently decomposed by the continued action of the acid. As a general rule all acids, whether organic or inorganic, act in the same manner when heated with cane-sugar. Even very dilute acids cause this transformation, though more slowly than acids which are somewhat more concentrated. (Malaguti, *Ann. Ch. et Phys.*, 1835, (2.) **59**. pp. 417, 422, 407.) The conversion of cane- into grape-sugar is most remarkable, it being only necessary to add a few percent of sulphuric acid to a solution of cane-sugar in order to bring about the formation of grape-sugar; and this change occurs even when no heat is applied to the mixture. Besides sulphuric acid, other acids easily transform cane- into grape-sugar in the cold; and even acetic acid produces this change at the temperature of boiling. (Mitscherlich, *Berlin Bericht*, 1841, p. 390.) All acids effect the complete conversion of cane-sugar, but strong acids more quickly than the same quantity of weaker acids, and the same acid acts more rapidly the higher the temperature. The change is complete with $\frac{1}{10}$ @ $\frac{1}{11}$ measure of chlorhydric acid at the temperature of the air in a few hours, the rotatory power then possessed by the liquid remaining constant for two days, or until coloration sets in. With sulphuric acid the transformation takes place slowly at the common temperature, but at 60° @ 70° instantaneously and without coloration of the liquid. A solution of cane-sugar, containing 66% of racemic acid, is only partially changed after 16 days, completely after a year; ¼ measure of glacial acetic acid does not occasion the transformation within 2 months, but completely within a year. (Biot, *C. R.*, **15**. 528 [*Gm.*].) Small quantities of organic acids do not sensibly increase the decomposing action of water at common temperatures. A 30% solution of cane-sugar mixed with $\frac{1}{10}$ of its weight of tartaric acid was not completely converted into inverse sugar after 5 years. (Maumené, *C. R.*, **39**. 917 [*Gm.*].) The cane-sugar of lemon-juice (containing 6.5% of acid) is only very slightly changed after 12 days, not more so than when the free acid is neutralized. The acid juice of the apricot may likewise be concentrated on the water-bath to half its bulk without the inversion of much of its cane-sugar. (Buignet.) If solutions of cane-sugar are heated with equivalent quantities of different acids, sulphuric acid causes inversion more quickly than tartaric acid, and tartaric acid more quickly than citric or than acetic acid. A larger quantity of the same acid is required if the sugar solution is dilute than if it is concentrated. (Buignet.)

In the transformation of cane-sugar by dilute acids there is produced grape-sugar (Kirchhoff), granular sugar (Guibourt, Boullay), gum-sugar (Bouillon-Lagrange), a sugar differing from ordinary (dextro-) glucose, which rotates the plane of polarization to the left (Biot), and is afterwards converted into ordinary (dextro-) glucose (Biot, Soubeiran). Cane-sugar heated with acids forms first lævo-glucose, and then, if the heat be continued, dextro-glucose. (Bouchardat.) But since boiling with acids does not alter the rotatory power of inverse sugar until coloration takes place, the crystals of dextro-glucose which are deposited after some months may be produced, not by the action of the acid, but by the molecular transformation which takes place in the course of time. (Soubeiran.)

Decomposed by concentrated sulphuric, chlorhydric, nitric, and arsenic acids.

When heated in closed tubes to 100° with aqueous solutions of the chlorides of sodium, barium, or strontium, more inverse sugar is formed than would be the case with pure water. The same transformation takes place quickly, the mass being blackened, with chloride of ammonium, but not with chloride of potassium, chloride of sodium, or fluorspar. (Berthelot.) Sugar solutions to which have been added alkaline chlorides, or the chlorides of the alkaline earths, or normal sulphates or carbonates behave like pure solutions of sugar when kept for a long time or boiled, since the salts in question exert no decomposing influence upon the sugar and do not alter it in any way; but most salts, and especially the chlorides of the alkalies and alkaline earths, hinder the crystallization of cane-sugar. Solutions, to which had been added 2 pts. of chloride of sodium, or chloride of calcium, for every 100 pts. of sugar, could not be made to crystallize until the salts had been removed by means of animal charcoal. Alkaline carbonates behave in the same way. But salts of nitric and sulphuric acid disturb the crystallization much less than chlorides. This action seems to be purely mechanical, since the uncrystallizable sugars behave in a similar way. (Hochstetter, *J. pr. Ch.*, 1843, **29**. pp. 28, 41.)

On heating a mixture of cane-sugar with 4 or 5 pts. of hydrate of potash and a small quantity of water oxalate of potash is formed. (Gay-Lussac.) When a solution of sugar, to which a small quantity of potash has been added, is boiled for a long time, out of contact with the air, the potash finally becomes saturated with ulmic acid; if the experiment is made in the air, formic acid is also produced. (Malaguti, *Ann. Ch. et Phys.*, 1835, (2.) **59.** pp. 420, 423.) Cane-sugar does not become sensibly brown when boiled with potash-lye. (Boullay; Chevalier.) A solution of cane-sugar heated with potash-lye to 88°, and then neutralized with acid, does not regain the whole of its rotatory power, which is still further diminished if the liquor is boiled or evaporated. Carbonate of potash does not diminish the rotatory power of cane-sugar when heated therewith to 88°; and when boiled it does so to a less extent than caustic potash. (Michaelis.) On boiling a solution of cane-sugar for 72 hours with $\frac{1}{50}$ pt. of crystallized carbonate of soda, an acid black liquor is formed possessing lævo-rotatory power. (Soubeiran.)

When a solution of cane-sugar, in which lime has been dissolved, is heated, even to 120°, or boiled for a long time, the cane-sugar undergoes no alteration; the lime even protecting this sugar from the decomposing influence which is exerted upon it at high temperatures, by nitrogenous matters. (Hochstetter, *J. pr. Ch.*, 1843, **29.** pp. 40, 27.) [Compare Oxide of Calcium, and Sucrate of Lime.] But under certain circumstances the alkalies may promote the decomposition of cane-sugar; for example, in presence of nitrogenized matters at temperatures favorable to processes of fermentation. (Hochstetter, *loc. cit.*, p. 40.) Solutions of cane-sugar mixed with hydrate of lime exhibit greater stability when boiled or long kept than pure aqueous sugar solutions. (Bouchardat, Soubeiran, and others.)

Moderately concentrated aqueous solutions of cane-sugar left in contact with certain nitrogenous bodies, at temperatures between 10° and 30°, undergo transformations distinguished by the names *Vinous*, *Lactous*, and *Mucous Fermentation;* for descriptions of which see Gmelin's *Handbook*, **7.** 96, and **15.** 265.) But cane-sugar is not altered either by diastase (Guérin-Varry), or by emulsin. (O. Schmidt.) When gelatinous, nitrogenized substances are present in solutions of cane-sugar the latter changes to uncrystallizable sugar before any phenomena of fermentation are apparent; and this change occurs as well after or during long-continued boiling. (Hochstetter, *J. pr. Ch.*, 1843, **29.** pp. 29 – 34, 40.) Cane-sugar does not undergo vinous fermentation till, under the influence of a peculiar substance in the yeast, or of a substance contained especially in the kernel of fruits, it has been resolved, with assumption of water, into lævo- and dextro-glucose. (Dubrunfaut, Berthelot, Buignet [*Gm.*].) It is converted, previous to fermentation, into uncrystallizable sugar (Dubrunfaut, 1838), lævo-rotatory sugar (Persoz, *C. R.*, **17.** 755), grape-sugar (H. Rose, *Pogg. Ann.*, **52.** 293 [*Gm.*]). The spontaneous fermentation which sacchiferous vegetable juices undergo on standing produces inversion of the cane-sugar contained in them. (Biot, *C. R.*, **15.** 528 [*Gm.*].)

Uncrystallizable Sugar. *(Fruit-Sugar. Lævo-Glucose.)* $C_{12}H_{12}O_{12}$ Very deliquescent. Readily soluble in water, and spirit; being more readily soluble in the latter than ordinary (dextro-)glucose. Insoluble in absolute alcohol or in ether.

Lævo-Glucose with Lime.

I.) Sparingly soluble in water. Decomposed $3\,CaO, C_{12}H_{12}O_{12}$ by water when exposed to light and air. (Dubrunfaut.)

II.) *basic.* Soluble in water.

Sugar of Gelatine. *Vid.* Glycocoll.

Grape-Sugar. *Vid.* Glucose.

Milk-Sugar. *Vid.* Lactin.

All the sugars are very soluble in water. (Berthelot.) Many of them are soluble in concentrated acetic acid.

Sugar(Cane) with Chloride of Sodium. $2(C_{12}H_{11}O_{11}); NaCl$ Deliquescent. Soluble in water. (Peligot.)

Sugar(Cane) with Sulphate of Copper. $C_{12}H_{11}O_{11}, CuO, SO_3 + 4\,Aq$ Soluble in water, the solution undergoing decomposition when boiled. (Barreswil.)

Sucrate (Cane-Sugar) of Baryta.

I.) *mono.* Sparingly soluble in cold water. $C_{12}H_{11}BaO_{11} + Aq$ (Dubrunfaut.) 100 pts. of water dissolve 2.1 pts. of it at 15° and 2.3 pts. at 100°; or 1 pt. of it dissolves in 47.6 pts. of water at 15°, and in 43.5 pts. of water at 100°; it being more soluble than sucrate of lime, No. III. (Peligot, *C. R.*, 1851, **32.** 334.) Insoluble in alcohol or wood-spirit.

II.) *biacid.?* Ppt., produced by alcohol in the solution of No. I. (Brendecke.)

Sucrate of Baryta & of Copper. Soluble in water, the solution behaving like that of the corresponding lime salt. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Baryta & *of protoxide* of Iron. Soluble in water, the solution behaving like that of the lime salt. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Baryta & of Lead. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Copper & of Lime. Permanent. Readily soluble in water. When the aqueous solution is heated to 71° in a flat open vessel a flaky blue precipitate separates, but this dissolves again completely as the solution cools. If the solution is heated in a deep narrow-mouthed vessel, however, as a test-tube, decomposition occurs, some dinoxide of copper being precipitated. Dinoxide of copper also separates, even in an open vessel, if an excess of sugar be present, but the presence of free alkali tends to retard this deoxidation. If, instead of heating the solution, it be left to itself, dinoxide of copper gradually separates, — more rapidly in closed than in open test-tubes, and much more rapidly in solutions to which an excess of sugar has been added; but very slowly in those containing an excess of alkali. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** pp. 153, 154.) Neither a solution of sugar nor of sucrate of lime will by itself dissolve hydrate of copper, but when these solutions are mixed they readily dissolve the hydrate, with combination.

Sucrate of Copper & of Potash. Soluble in water, and no precipitate is formed on heating, unless free sugar be present, in which case dinoxide of copper falls down. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Copper & of Soda. Soluble in water, and no precipitate is formed on heating this solution, unless free sugar be present, in which case dinoxide of copper is precipitated. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Copper & of Strontia. Soluble in water, the solution behaving like that of the corresponding lime salt. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate *of protoxide* of Iron. Very soluble
$C_{12}H_{10}FeO_{11}$? in water. Insoluble in alcohol. (Gladstone, *J. Ch. Soc.*, **7.** 196.)

Sucrate *of protoxide* of Iron & of Lime. Soluble in water, but the solution is very liable to undergo decomposition, both in closed and open vessels, carbonates of lime and iron being formed. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 155.)

Sucrate *of protoxide* of Iron & of Potash. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate *of protoxide* of Iron & of Soda. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate *of protoxide* of Iron & of Strontia. Soluble in water, the solution behaving like that of the corresponding lime salt. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Lead. Insoluble in water, whether
$C_{12}H_9Pb_2O_{11}$ cold or boiling. Easily soluble in acids, and in an aqueous solution of acetate of lead. Soluble in an aqueous solution of cane-sugar.

Sucrate of Lead & of Lime. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 155.)

Sucrate of Lead & of Potash. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Lead & of Soda. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Lead & of Strontia. Soluble in water. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Lime.

I.) *mono.* Very soluble in water. Insoluble in
$C_{12}H_{10}CaO_{11} + Aq$ spirit of 85%, but soluble in an alcoholic solution of sugar. (Brendecke.)

When the aqueous solution is heated it becomes cloudy, and finally coagulates completely if sufficiently concentrated, the compound No. 3 being precipitated (Peligot), but when the temperature is allowed to fall this precipitate redissolves, the liquid becoming perfectly limpid and transparent, even before it is completely cold. (Lowitz, *Crell's Chem. Ann.*, **1.** 347, cited by Schweigger, in his *Journ. für Ch. u. Phys.*, **5.** 53; Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** 292, and *Kastner's Archiv.*, 1824, **3.** 212; Peligot, *C. R.*, 1851. **32.** 333.) The precipitate disappears on adding to the hot liquid, cane-sugar, glucose, lactine, or mannite. (Brendecke.) Dilute solutions of sucrate of lime become turbid at 80°, and more concentrated solutions at 100°; no precipitate is formed on heating very highly concentrated solutions. (Dubrunfaut.)

II.) *di.*

a = $C_{12}H_{11}O_{11}, 2(CaO, HO)$ This compound may be isolated by carefully evaporating the aqueous solution of sucrate of lime at temperatures below 82°, at which temperature it is insoluble in water; or by adding alcohol, which precipitates it from the aqueous solution. (Hunton, *Phil. Mag.*, 1837, (3.) **11.** 153.)

b = $C_{12}H_9Ca_2O_{11} + 2Aq$ May be admitted, according to Peligot, as the compound which tends to be produced when lime is dissolved in a solution of No. 1.

For the amounts of lime which can be dissolved by solutions of sugar of different densities, see Oxide of Calcium.

On attempting to saturate with lime a syrup containing more than about 30% of sugar the solution becomes very viscous, and after a time solidifies. An immediate precipitation of the sugar may also be brought about by adding lime to a syrup of 35° B., when a solid calcareous compound is formed, which is insoluble, or only very slightly soluble. But in both these cases the precipitate is mixed with an excess of free hydrate of lime. (Péligot, *C. R.*, **32.** 336.)

III.) *tri.* Almost insoluble, either in cold or
$C_{12}H_9Ca_2O_{11}, CaO, HO + 2Aq$ in boiling water. 100 pts. of cold water dissolve less than 1 pt. of it; and on heating this cold saturated solution half of the sucrate which it contains is precipitated; hence at least 200 pts. of boiling water are required in order to dissolve 1 pt. of this compound. It is consequently less soluble than the baryta salt. Very soluble in an aqueous solution of cane-sugar. (Péligot, *C. R.*, 1851, **32.** pp. 333, 334.) See also above, under No. I.

IV.) *sesqui?* Readily soluble in water, a pre-
$2C_{12}H_{11}O_{11}, 3CaO$ cipitate being formed when this solution is heated. Insoluble in alcohol or spirit. (Brendecke.) Soluble in an alcoholic solution of sugar. (Soubeiran.)

Péligot disproves the existence of this compound (Soubeiran's). Compare Berthelot, *Ann. Ch. et Phys.*, (3.) **46.** 180.) A saturated solution of lime in sugar-water having been boiled continually during 2 hours over a free fire, the water being replaced as it evaporated, no uncrystallizable sugar was formed. (Hochstetter, *J. pr. Ch.*, 1843, **29.** 27.)

Sucrate of Magnesia. Soluble in water.

Sucrate of Potash. Readily soluble in
$C_{12}H_{10}KO_{11} + Aq$? water. Scarcely soluble in alcohol, but readily soluble in an alcoholic solution of sugar. (Brendecke; compare Hunton, *Phil. Mag.*, 1837, (3.) **11.** 156.)

Sucrate of Soda. Similar to the Potash
$C_{12}H_{10}NaO_{11} + Aq$? Compound.

Sucrate of Strontia. Efflorescent. Soluble in water.

Sudoric Acid. Soluble in absolute alcohol.
(*Hydrotic Acid.*) The salts of sudoric acid are all
$C_{10}H_9NO_{14}$ soluble in water, and in absolute alcohol, excepting the silver salt.

Sudorate of Silver. Insoluble in absolute
$C_{10}H_8AgNO_{14}$ alcohol.

*Mono*Sulhyposulphuric Acid. *Vid. tri*-Thionic Acid.

*Bi*Sulhyposulphuric Acid. *Vid. tetra*Thionic Acid.

*Ter*Sulhyposulphuric Acid. *Vid.* Pentathionic Acid.

SulphAcetic Acid. Very deliquescent. Sol-
(*SulphAcetylic Acid.*) uble in water.
$C_4H_4S_2O_{10} = C_4H_2O_2'', 2HO, S_2O_6$ The metallic salts of sulphacetic acid all appear to be soluble in water. Alcohol precipitates them from the aqueous solution.

SulphAcetate of Ammonia. Soluble in water, from which it is precipitated on the addition of alcohol. (Melsens.)

SulphAcetate of Baryta.

I.) *normal.* Soluble in water, from which solu-
$C_4H_2Ba_2S_2O_{10} + 3Aq$ tion it is precipitated on the addition of alcohol. There appears to be two or more different salts. When it has been deposited as an amorphous

powder, it is very difficult to redissolve it; and after having been dried at 250°, it is still more difficultly soluble in water. In both cases, however, it is immediately dissolved when treated with chlorhydric acid (Melsens, *Ann. Ch. et Phys.*, (3.) **10**. 373.)

SulphAcetate *of protoxide* **of Iron.** Soluble in water, from which solution it is precipitated on the addition of alcohol. (Melsens, *loc. cit.*)

SulphAcetate of Lead. Permanent. Soluble in water, from which it is precipitated on the addition of alcohol. (Melsens, *loc. cit.*)
$C_4H_2Pb_2S_2O_{10}$

SulphAcetate of Lime. Soluble in water, from which it is precipitated on the addition of alcohol. (Melsens, *loc. cit.*)

SulphAcetate *of protoxide* **of Mercury.** Soluble in water, from which it is precipitated on the addition of alcohol. (Melsens, *loc. cit.*)

SulphAcetate of Potash. Soluble in water, especially when this is hot.
$C_4H_2K_2S_2O_{10} + 2\,Aq$

SulphAcetate of Silver. Soluble in water, from which it is precipitated on the addition of alcohol. (Melsens, *loc. cit.*)
$C_4H_2Ag_2\,S_2O_{10}$

SulphAcetate of Soda. Soluble in water. (Melsens, *loc. cit.*)

SulphAcetoThymic Acid. *Vid.* ThymylSulphAcetic Acid.

SulphAcetoVinic Acid. Soluble in water, and absolute alcohol. (Melsens, *Ann. Ch. et Phys.*, (3.) **10**. 377.)

SulphAcetoVinate of Silver. Hygroscopic. More soluble than sulphacetate of silver in water. Soluble in hot, less soluble in cold absolute alcohol. (Melsens, *loc. cit.*)
$C_8H_2Ag_2S_4O_{12}$

SulphAcetylic Acid. *Vid.* Ethionic Acid.

SulphAldehyde. *Vid.* Hydride of SulphAcetyl.

SulphAllylAnilinUrea. *Vid.* PhenylThiosinamin.

Sulphamic Acid.

$$NH_3S_2O_6 = N\left\{\begin{matrix}S_2O_4''\\H_2\end{matrix}\right. .O, HO$$

Sulphamate of Baryta. Soluble in water. (Laurent, in his *Chemical Method*, p. 250.)

Sulphamate of Lead. Soluble in water. (Laurent, *loc. cit.*)

Sulphamate of Lime. Soluble in water. (Laurent, *loc. cit.*, p. 251.)

Sulphamate of Methyl. Very deliquescent. Miscible, in all proportions, with water.
(*SulphoMethylane.*)
$N\left\{\begin{matrix}S_2O_4''\\H_3.(C_2H_3)\end{matrix}\right\}O_2$

Sulphamate of Silver. Soluble in water. (Laurent, *loc. cit.*, p. 250.)

I.) **Sulphamid.** Soluble in 9 pts. of cold water. Permanent. Decomposed by aqueous solutions of the caustic alkalies.
(*Sulphate of Ammon*, of H. Rose.)
a = (NH_3SO_3) or $N_2\left\{\begin{matrix}S_2O_4''\\H_4\end{matrix}\right. + 2\,HO$

α) *pulverulent.* } There are two forms of this
β) *crystalline.* } compound, both of which are soluble, without decomposition, in cold water, but when the aqueous solution is heated higher than 50° the compound is converted into sulphate of ammonium (NH_4O, SO_3); this transformation is especially rapid when the solution is boiled, and is more readily effected with the amorphous than with the crystalline variety. The presence of free acids generally accelerates the transformation. (H. Rose, in *Berzelius's Lehrb.*, **3**. 299.)

b = *Sulphamid* (of Regnault). Very deliquescent. Almost equally soluble with chloride of ammonium in water, and alcohol.
$N_2\left\{\begin{matrix}H_4\\S_2O_4''\end{matrix}\right.$

II.) *Sulphamid* (of Jacquelain). Permanent. Very soluble in water with reduction of temperature. Alcohol precipitates it from the aqueous solution. Soluble in cold concentrated sulphuric acid, decomposing when the solution is heated. (Jacquelain, *Ann. Ch. et Phys.*, (3.) **8**. pp. 301, 306, 309.)
"$3\,N_2H_6, 4\,SO_3$"

Sulphamid (No. 2) with Ammonia & Baryta. Sparingly soluble in water. Insoluble in alkaline water. Completely dissolved by dilute chlorhydric acid, which retains it only for a few minutes, however. Decomposed by warm concentrated sulphuric acid. (Jacquelain, *loc. cit.*, pp. 306, 309.)

Sulphamid (No. 2) with Baryta. Insoluble [or very sparingly soluble?] in water or in alcohol. (Jacquelain, *loc. cit.*, p. 304.)
"$(N_2H_6, 2\,BaO)\,3\,SO_3$"

Sulphamid (No. 2) & Lead. Insoluble in water. (Jacquelain, *loc. cit.*, p. 307.)

Sulphamid (No. 1) with Sulphate of Ammonia. Deliquescent. Very easily soluble in water. (H. Rose.)
NH_3, SO_3; NH_4O, SO_3

SulphAmidonic Acid. Deliquescent. Soluble in water. The aqueous solution decomposes readily. Its salts are soluble in water.

SulphAmidonate of Baryta. Easily soluble in water, the solution undergoing decomposition when heated.

SulphAmidonate of Lead. Soluble in water.

SulphAmidonate of Lime. Soluble in water, from which it is precipitated on the addition of alcohol.

SulphAmylic Acid. *Vid.* AmylSulphuric Acid.

SulphAmylSulphuric Acid. *Vid.* AmylSulphurous Acid.

SulphAnilic Acid. Sparingly soluble in cold, more soluble in boiling water. Less soluble in alcohol than in water. (Gerhardt.)
(*PhenylSulphamic Acid. AnilinSulphuric Acid.*)
$C_{12}H_7NS_2O_6 = N\left\{\begin{matrix}S_2O_4''\\C_{12}H_5\\H\end{matrix}\right. .O, HO$

SulphAnilate of Ammonia. Very soluble in water.
$C_{12}H_6(NH_4)NS_2O_6$

SulphAnilate of Anilin. Soluble in water.

SulphAnilate of Baryta. Tolerably soluble in water.
$C_{12}H_6BaNS_2O_6$

SulphAnilate of Copper. Soluble in water.
$C_{12}H_6CuNS_2O_6 + 4\,Aq$

SulphAnilate of Silver. Soluble in water.
$C_{12}H_6NAgS_2O_6$

SulphAnilate of Soda. Soluble in water, and in boiling alcohol. Insoluble in ether.
$C_{12}H_6NaNS_2O_6 + 2\,Aq$

*Bi*SulphAnilic Acid. $C_{12} H_7 N S_4 O_{12} = C_{12} H_7 N, 4 S O_3$ Easily soluble in water. Insoluble in alcohol or ether. (Buckton & Hofmann.)

*Bi*SulphAnilate of Baryta. $C_{12} H_5 Ba_2 N S_4 O_{12}$ Easily soluble in water. Insoluble in alcohol or ether.

*Bi*SulphAnilate of Silver. $C_{12} H_5 Ag_2 N S_4 O_{12}$ Soluble in water. Insoluble in alcohol, and ether. (Buckton & Hofmann.)

SulphAnilid. Tolerably soluble in water. Soluble in concentrated sulphuric acid, from which it is reprecipitated on the addition of water. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **15.** 92.)

SulphAnisic Acid. (*AnisSulphuric Acid.*) $C_{16} H_8 S_2 O_{12} + 2 Aq = C_{16} H_6 O_2, 2 H O, 2 S O_4 + 2 Aq$ Permanent. Soluble in water. Insoluble in alcohol. Soluble in ether. (Zervas, *J. Ch. Soc.*, **10.** 214.)

SulphAnisate of Ammonia. Soluble in water.

SulphAnisate of Baryta. $C_{16} H_6 Ba_2 S_2 O_{12} + 2 Aq$ & $8 Aq$ Readily soluble in water, but becomes less soluble after repeated crystallization. (Zervas.) Easily soluble in water, from which it is precipitated on the addition of alcohol. (Limpricht.)

SulphAnisate of Lead.

I.) *normal.* $C_{16} H_6 Pb_2 S_2 O_{12} + 2 Aq$ & $8 Aq$ Sparingly soluble in cold, somewhat more readily soluble in hot water. By repeated crystallization its solubility is diminished. Insoluble in alcohol. (Zervas.)

II.) *acid.* $C_{16} H_7 Pb S_2 O_{12} + 2 Aq$ Easily soluble in cold and in hot water.

SulphAnisate of Magnesia. Readily soluble in water.

SulphAnisate of Potash. Soluble in water.

SulphAnisate of Silver. Somewhat difficultly soluble in water. (Zervas.) Sparingly soluble in water, especially after recrystallization. (Limpricht.)

SulphAnisolic Acid. *Vid.* Sulphate of Toluenyl, No. II.

*Bi*SulphAnisolic Acid. $C_{14} H_8 S_4 O_{14}$

*Bi*SulphAnisolate of Baryta. $C_{14} H_6 Ba_2 S_4 O_{14} + 2 Aq$ Soluble in water.

*Bi*SulphAnisolate of Lead. Soluble in water. Insoluble, or but sparingly soluble, in alcohol. (Zervas, *J. Ch. Soc.*, **10.** 215.)

SulphAnisolid. *Vid.* Sulphate of Toluenyl, No. I.

SulphAnisylous Acid. *Vid.* Hydride of SulphAnisyl.

SulphAntimonic Acid. $Sb S_5$ *Vid. quinqui*Sulphide of Antimony. The alkaline salts of sulphantimonic acid are soluble in water, but these solutions slowly undergo decomposition when exposed to the air. Most of the sulphantimoniates of the metals proper are insoluble in water. All sulphantimoniates are insoluble in alcohol. (Rammelsberg.)

SulphAntimoniate of Ammonium. $3 N H_4 S, Sb S_5$ Soluble in cold water, free from air. Decomposed by hot water. Decomposed by alcohol, ether, and acids.

SulphAntimoniate of Barium. $3 Ba S, Sb S_5 + 6 Aq$ Soluble in water. Insoluble in alcohol. (Rammelsberg.)

SulphAntimoniate of Bismuth. $Bi S_3, Sb S_5$

SulphAntimoniate of Cadmium. $3 Cd S, Sb S_5$ Ppt.

SulphAntimoniate of Calcium. $3 Ca S, Sb S_5$ Partially soluble in water. Insoluble in alcohol. (Rammelsberg.)

SulphAntimoniate of Cobalt. $3 Co S, Sb S_5$ Ppt. Decomposed by chlorhydric acid. (Rammelsberg.)

SulphAntimoniate of Copper. $3 Cu S, Sb S_5$ Ppt.

SulphAntimoniate of Copper & of Iron.

SulphAntimoniate of Iron.

SulphAntimoniate of Lead. $3 Pb S, Sb S_5$ Decomposed by an aqueous solution of caustic potash.

SulphAntimoniate of Magnesium. $3 Mg S, Sb S_5$ Deliquescent. Soluble in water. Decomposed by alcohol. (Rammelsberg.)

SulphAntimoniate of Manganese. $3 Mn S, Sb S_5$ Ppt.

SulphAntimoniate *of disulphide* of Mercury. $3 Hg_2 S, Sb S_5$ Ppt.

SulphAntimoniate *of protosulphide* of Mercury. $3 Hg S, Sb S_3$ Ppt.

SulphAntimoniate of Nickel. $3 Ni S, Sb S_5$ Decomposed by hot chlorhydric acid. (Rammelsberg.)

SulphAntimoniate of Potassium. $3 K S, Sb S_5 + 9 Aq$ Deliquesces, with decomposition. Soluble in water. More soluble in water than the sodium salt. (Rammelsberg.)

SulphAntimoniate of Silver. $3 Ag S, Sb S_5$ Insoluble in water. Decomposed by an aqueous solution of caustic potash.

SulphAntimoniate of Sodium. (*Schlippe's salt.*) $3 Na S, Sb S_5 + 18 Aq$

Soluble in 3 pts. of cold water (Van den Corput);
" 4 " (Duflos);
" 2.9 pts. of water at 15° (Rammelsberg);
" 1 pt. of boiling water (Duflos).
Insoluble in alcohol, (Van den Corput);
or in dilute alcohol. (Rammelsberg).

SulphAntimoniate of Strontium. $3 Sr S, Sb S_5$ Soluble in water. Alcohol precipitates a dense oily liquid when added to the aqueous solution. (Rammelsberg.)

SulphAntimoniate *of protosulphide* of Tin.

SulphAntimoniate of Uranium.

SulphAntimoniate of Zinc.

I.) *normal.* $3 Zn S, Sb S_5$ Soluble in a boiling aqueous solution of sulphantimoniate of sodium; insoluble in a solution of sulphate of zinc. Partially soluble, with decomposition, in a solution of caustic potash. Soluble in boiling chlorhydric acid. (Rammelsberg.)

SulphAntimonious Acid. $Sb S_3$ *Vid. ter*Sulphide of Antimony. The alkaline sulphantimonites are decomposed by water, the sulphide of the alkali in combination with a small quantity of the tersulphide of antimony dissolving, while the greater part of the latter remains undissolved. (Berzelius's *Lehrb.*, **2.** 299.)

SulphAntimonite of Barium. Partially soluble in water. (Pagenstecher.)

SulphAntimonite *of disulphide* of Copper.
$Cu_2 S, Sb S_2$

SulphAntimonite of Iron.

I.) Soluble, with decomposition, in cold chlorhydric acid.
$Fe S, Sb S_3$

II.) $3 Fe S, 2 Sb S_3$

III.) $3 Fe S, 4 Sb S_3$

SulphAntimonite of Lead. Soluble, with decomposition, in hot concentrated chlorhydric and nitric acids.

SulphAntimonite of Lead & of Silver.
$3 Pb S, 2 Ag S, 2 Sb S_3$

SulphAntimonite of Potassium. Deliquescent. Those samples which contain an excess of the alkaline sulphide are completely soluble in water, while those which contain an excess of $Sb S_3$ are partially insoluble. The aqueous solution is decomposed by all acids, including carbonic acid, and by solutions of the carbonates of potash and soda, and the bicarbonates of potash, soda, and ammonia. The crystalline salt is insoluble in absolute alcohol, but is dissolved by dilute alcohol in proportion to the water which this contains. (Kohl.)
$5 K S, 2 Sb S_3 + 10 Aq$;
or rather, $(K S)_x, (Sb S_3)_x$

SulphAntimonite of Silver.
Various compounds from $Ag S, Sb S_3$ to $6 Ag S, Sb S_3$

SulphAntimonite of Sodium.

I.) Deliquescent. Decomposed by hot water. Those samples which contain an excess of $Na S$ are entirely soluble in water, but those in which $Sb S_3$ predominates are only partially soluble.

II.) Permanent. Easily soluble in water. Insoluble in alcohol or ether. (Kohl.)
$4 Na S : 3 Sb S_3 + 3 Aq$

SulphAntimonite of Stib*tri*Amyl. Insoluble in water, alcohol, or ether. (Berlé.)
$Sb \left\{ (C_{10} H_{11})_3 S_2, 2 Sb S_3 \right.$

SulphAntimonite of Stib*tri*Ethyl. Ppt.
$C_{12} H_{15} Sb_3 S_8 = Sb \left\{ (C_4 H_5)_3 S_2, 2 Sb S_3 \right.$

SulphArsenic Acid. *Vid. quinqui*Sulphide of Arsenic. The sulpharseniates of the alkalies and alkaline earths are soluble in water, but the others, with a few exceptions, are insoluble. The solution may be readily preserved when concentrated, but when dilute it is slowly decomposed.
$As S_5$

SulphArseniate of Aluminum. Ppt. (Berzelius [T.].)

SulphArseniate of Ammonium.

I.) *tris.* Tolerably permanent. Soluble in water. Sparingly soluble in alcohol. (Berzelius.)
$3 N H_4 S, As S_5$

II.) *di.* Soluble in water, and in ammonia-water. Insoluble in alcohol. (Berzelius.)
$2 N H_4 S, As S_5$

III.) *mono.* Soluble in alcohol.
$N H_4 S, As S_5$

IV.) *peracid.* Insoluble in water.
$N H_4 S, 12 As S_5$

SulphArseniate of Ammonium & of Magnesium. Easily soluble in water. Insoluble in alcohol. (Berzelius.)
$N H_4 S, 2 Mg S, As S_5$

SulphArseniate of Ammonium & of Sodium. Permanent. Much more easily soluble in water than the sodium-salt by itself. Sparingly soluble in cold, more soluble in hot spirit. (Berzelius's *Lehrb.*)
$3 N H_4 S, As S_5 ; 3 Na S, As S_5$

SulphArseniate of Barium.

I.) *tris.* Easily soluble in water. Sparingly soluble in alcohol.
$3 Ba S, As S_5$

II.) *di.* Soluble in all proportions in water. Decomposed by alcohol.
$2 Ba S, As S_5$

III.) *mono.* Soluble in alcohol.
$Ba S, As S_5$

IV.) *acid.* Insoluble in water.
$Ba S, 3 As S_5$ (?)

SulphArseniate of Bismuth.

I.) $2 Bi S_3, 3 As S_5$
II.) $Bi S_3, 3 As S_5$
Soluble in an aqueous solution of sulpharseniate of sodium. (Berzelius.)

SulphArseniate of Cadmium. Ppt.
$2 Cd S, As S_5$

SulphArseniate of Calcium.

I.) *tris.* Easily soluble in water. Insoluble in alcohol.
$3 Ca S, As S_5$

II.) *di.* Hygroscopic. Easily soluble in water, and alcohol. (Berzelius.)
$2 Ca S, As S_5$

SulphArseniate *of protosulphide* of Cerium.

I.) *tris.*
II.) *di.*
$2 Ce S, As S_5$
Ppts.

SulphArseniate *of sesquisulphide* of Cerium. Slightly soluble in water. (Berzelius's *Lehrb.*)
$2 Ce_2 S_3, 3 As S_5$

SulphArseniate *of sesquisulphide* of Chromium. Ppt.
$2 Cr_2 S_3, 3 As S_5$

SulphArseniate of Cobalt.

I.) *di.* Soluble in an aqueous solution of sulpharseniate of sodium. (Berzelius.)
$2 Co S, As S_5$

SulphArseniate of Copper.

I.) *di.* Soluble, for the most part, in an aqueous solution of sulphide of ammonium. (Anthon.) Ammonia-water, when very dilute, takes up only the $As S_5$, but when stronger dissolves also some $Cu S$. (Gmelin.)
$2 Cu S, As S_5$

SulphArseniate of Glucinum. Somewhat soluble in water.
$2 Gl_2 S_3, 3 As S_5$

SulphArseniate of Gold.

I.) Soluble in water. Insoluble in an aqueous solution of trisulpharseniate of sodium. (Berzelius.)
$Au S_3, As S_5$

II.) Soluble in water. Insoluble in an aqueous solution of disulpharseniate of sodium. (Berzelius.)
$2 Au S_3, 3 As S_5$

SulphArseniate *of protosulphide* of Iron. Soluble in an aqueous solution of di or trisulpharseniate of sodium. (Berzelius.)
$2 Fe S, As S_5$

SulphArseniate *of sesquisulphide* of Iron. Partially soluble in an aqueous solution of di or trisulpharseniate of sodium. (Berzelius.)
$2 Fe_2 S_3, 3 As S_5$

SulphArseniate of Lead.

I.) *tris.* Ppt.

II.) *di.* Ppt.
$2 Pb S, As S_5$

SulphArseniate of Lithium.

I.) *tris.* Easily soluble in water. Sparingly soluble in dilute alcohol.
$3 Li S, As S_5$

II.) *di.* Permanent. Completely soluble in water. Decomposed by alcohol.
$2 Li S, As S_5$

III.) *acid.*
IV.) *hyperacid.*
Similar to the corresponding sodium-salts.

SulphArseniate of Magnesium.

I.) *tris.* $3\,MgS, AsS_5$ Hygroscopic. Soluble in water. Decomposed by alcohol, which dissolves out No. 2.

II.) *di.* $2\,MgS, AsS_5$ Permanent. Soluble in water in all proportions. Soluble in alcohol. (Berzelius.)

III.) *polybasic.* Nearly insoluble in water. Insoluble in alcohol.

SulphArseniate of Manganese.

I.) *di.* Somewhat soluble in water.
$2\,MnS, AsS_5$

II.) *tri.* $3\,MnS, AsS_5$ Permanent. Somewhat soluble in water. (Berzelius.)

SulphArseniate *of disulphide* of Mercury.

I.) *di.* Ppt.
$2\,Hg_2S, AsS_5$

SulphArseniate *of protosulphide* of Mercury. $2\,HgS, AsS_5$ Ppt.

SulphArseniate of Nickel.

I.) *tris.* $3\,NiS, AsS_5$
II.) *di.* $2\,NiS, AsS_5$
Ppts. Soluble in an aqueous solution of sulpharseniate of sodium. Insoluble in chlorhydric acid. (Berzelius.)

SulphArseniate *of bisulphide* of Platinum. PtS_2, AsS_5 Soluble in water.

SulphArseniate of Potassium.

I.) *tris.* $3\,KS, AsS_5$ Deliquescent. Soluble in water. Insoluble in alcohol.

II.) *di.* $2\,KS, AsS_5$ Deliquescent. Soluble in water. Alcohol precipitates a strong aqueous solution of No. 1.

III.) *mono.* Soluble in alcohol. (Berzelius.)
KS, AsS_5

IV.) *peracid.* Insoluble in water.
$KS, 12\,AsS_5$

SulphArseniate of Potassium & of Sodium.

I.) *tris.* Soluble in water. (Berzelius.)

SulphArseniate of Silver.

I.) *tris.* $3\,AgS, AsS_5$
II.) *di.* $2\,AgS, AsS_5$
Ppts.

SulphArseniate of Sodium.

I.) *tris.* $3\,NaS, AsS_5 + 15\,Aq$ Permanent. Easily and abundantly soluble in water, especially if this be warm. Insoluble in alcohol. (Berzelius.)

II.) *di.* $2\,NaS, AsS_5$ Hygroscopic. Soluble in water. Alcohol precipitates No. 1 from the aqueous solution. (Berzelius, *Lehrb.*)

III.) *mono.* NaS, AsS_5 Soluble in alcohol, and is known only in alcoholic solution. (Berzelius.)

IV.) *peracid.* Insoluble in water.
$NaS, 12\,AsS_5$

SulphArseniate of Strontium.

I.) *tris.* Easily soluble in water. (Berzelius.) Insoluble in alcohol.

II.) *di.* $2\,SrS, AsS_5$ Easily soluble in water. Alcohol precipitates No. 1 from the aqueous solution. (Berzelius, *Lehrb.*)

SulphArseniate *of protosulphide* of Tin. $2\,SnS, AsS_5$ Ppt.

SulphArseniate *of bisulphide* of Tin. Ppt.
SnS_2, AsS_5

SulphArseniate *of sesquisulphide* of Uranium. $2\,Ur_2S_3, AsS_5$ Ppt. Soluble in an aqueous solution of sulpharseniate of sodium, as is also the trisalt.

SulphArseniate of Yttrium. $2\,YS, AsS_5$ Slightly soluble in water.

SulphArseniate of Zinc.

I.) *tris.* Ppt.
$3\,ZnS, AsS_5$

II.) *di.* Ppt.
$2\,ZnS, AsS_5$

III.) *mono.*
ZnS, AsS_5

SulphArseniate of Zirconium. $2\,Zr_2S_3, 3\,AsS_5$ Insoluble in water. It is not in the least acted upon by acids. (Berzelius, *Lehrb.*)

SulphArsenious Acid. *Vid. ter*Sulphide of. AsS_3 The only sulpharsenites which are soluble in water are those which contain the alkaline and alkaline-earthy sulphides, or sulphide of magnesium; and even these are decomposed by water, unless this is present in considerable quantity. Hence the solutions are decomposed by evaporation.

SulphArsenite of Ammonium.

I.) *tri.* $3\,NH_4S, AsS_3$ Decomposes in the air. Soluble in water, or at least in an aqueous solution of sulphide of ammonium. Insoluble, or very sparingly soluble, in alcohol. (Berzelius, *Lehrb.*)

II.) *di.* $2\,NH_4S, AsS_3$ Soluble in water. Alcohol, when added to the aqueous solution, precipitates the tri (No. 1) salt. (*Ibid.*)

SulphArsenite of Barium.

I.) *tri.* Difficultly soluble in water. Insoluble in alcohol.

II.) *di.* $2\,BaS, AsS_3$ Difficultly soluble in water. Decomposed by alcohol.

SulphArsenite of Bismuth. Ppt.
$2\,BiS_3, 3\,AsS_5$

SulphArsenite of Cadmium. Ppt.
$2\,CdS, AsS_3$

SulphArsenite of Calcium.

I.) *tri.* $3\,CaS, AsS_3 + 15\,Aq$ Soluble in water. Insoluble in alcohol.

II.) *di.* $2\,CaS, AsS_3$ Soluble in water. Alcohol precipitates the tri-salt from the aqueous solution, but also dissolves a portion of the disalt. (Berzelius, *Lehrb.*, **3**. 429.)

SulphArsenite of Cerium. $2\,CeS, AsS_3$ Very slightly soluble in water.

SulphArsenite *of sesquisulphide* of Chromium. $2\,Cr_2S_3, 3\,AsS_3$ Ppt. Insoluble in an aqueous solution of sulphide of sodium.

SulphArsenite of Cobalt. $2\,CoS, AsS_3$ Soluble in an aqueous solution of sulpharsenite of sodium. (Berzelius.)

SulphArsenite of Copper.

I.) *tris.* $3\,CuS, AsS_3$ Soluble in aqueous solutions of the alkaline arsenites.

II.) *di.* Ppt.
$2\,CuS, AsS_3$

III.) *basic.* $12\,CuS, AsS_3$ Insoluble in aqueous solutions of the alkaline sulphides.

SulphArsenite of Glucinum. Gl_2S_3, AsS_3 Slightly soluble in water. Decomposed by ammonia-water. (Berzelius, *Lehrb.*)

SulphArsenite *of tersulphide* of Gold. $2\,AuS_3, 3\,AsS_3$ Insoluble in water. (Berzelius.)

SulphArsenite *of protosulphide* of Iron. $2\,FeS, AsS_5$ Soluble in an aqueous solution of sulpharsenite of sodium. (Berzelius.)

SulphArsenite *of sesquisulphide* **of Iron.** $2 Fe_2S_3, 3 AsS_3$ Soluble in an aqueous solution of sulpharsenite of sodium. (Berzelius.)

SulphArsenite of Lead.
I.) *di.* Ppt.
$2 PbS, AsS_3$

SulphArsenite of Lithium. Similar to $2 LiS, AsS_3$ the potassium compounds.

SulphArsenite of Magnesium. Easily $2 MgS, AsS_3$ soluble in water. Decomposed when treated with a small quantity of water, and also when the aqueous solution is evaporated. Easily soluble in alcohol. (Berzelius.)

SulphArsenite of Manganese. Ppt. De- $3 MnS, AsS_3$ composed by chlorhydric acid.

SulphArsenite *of bisulphide* **of Molybdenum.**

SulphArsenite *of disulphide* **of Mercury.**
I.) *di.* Ppt.
$2 Hg_2S, AsS_3$

SulphArsenite *of protosulphide* **of Mercury.**
I.) *di.* Ppt.
$2 HgS, AsS_3$
II.) *mono.*
HgS, AsS_3

SulphArsenite of Nickel. Ppt.
$2 NiS, AsS_3$

SulphArsenite *of bisulphide* **of Platinum.**
PtS_2, AsS_3 Ppt.

SulphArsenite of Potassium.

I.) *tris.* Soluble in water. Insoluble in alco- $3 KS, AsS_3$ hol. Decomposed when treated with a small quantity of water, and also when the aqueous solution is evaporated.

II.) *di.* Soluble in water. Decomposed by $2 KS, AsS_3$ alcohol. Decomposed by evaporation, and by small quantities of water, like No. 1.

III.) *mono.* Soluble in water, and in alcohol.
KS, AsS_3

IV.) *peracid.* Insoluble in water.
$KS, x AsS_3$

SulphArsenite of Silver.

$$\left.\begin{array}{ll} \text{I.)} & 3 AgS, AsS_3 \\ \text{II.)} & 2 AgS, AsS_3 \\ \text{III.)} & AgS, AsS_3 \\ \text{IV.)} & 12 AgS, AsS_3 \end{array}\right\}$$

Alkaline solutions dissolve out AsS_3. Partially soluble, with decomposition, in nitric acid.

SulphArsenite of Sodium. Similar to the potassium compounds.

SulphArsenite of Strontium.

I.) *tris.* Soluble in water. Insoluble in alco- $3 CaS, AsS_3 + 15 Aq$ hol. (Voigt & Gœttling.)

II.) *di.* Soluble in water. Decomposed by alcohol.

SulphArsenite *of protosulphide* **of Tin.** Ppt.
$2 SnS, AsS_3$

SulphArsenite *of bisulphide* **of Tin.** Ppt.
SnS_2, AsS_3

SulphArsenite *of sesquisulphide* **of Uranium.** Ppt.
$2 Ur_2S_3, AsS_3$

SulphArsenite of Yttrium. Partially $2 YS, AsS_3$ soluble in an aqueous solution of sulphide of sodium.

SulphArsenite of Zinc. Ppt.
$2 ZnS, AsS_3$

SulphArsenite of Zirconium. Slightly $2 Zr_2S_3, AsS_3$ soluble in an aqueous solution of sulphide of sodium. Not decomposed by acids. (Berzelius.)

SulphAurate of Potassium. Soluble in (*AuroSulphate of Potash.*) water. (Yorke, *J. Ch. Soc.*, **1.** 244.)

SulphAurate of Sodium. Decomposes in $NaS, AuS + 8 Aq$ the air. Very soluble in water. Soluble in spirit. (Yorke, *loc. cit.*, p. 240.)

Sulphuric Acid (Anhydrous). Miscible in SO_3 all proportions in water, dissolving therein with evolution of much heat. Soluble in strong acetic acid. Soluble, with decomposition, in alcohol, and ether.

Sulphuric Acid.
(*Oil of Vitriol.*)

a = *monohydrated.* Sp. gr. = 1.848. It boils HO, SO_3 at 288° (Henry), at 327° (Dalton). Miscible in all proportions with water, alcohol, and strong vinegar.

b = *bihydrated.* Sp. gr. = 1.780.
$2 HO, SO_3$

c = $3 HO, SO_3$ Sp. gr. = 1.6321. It boils at 163° @ 170°. (Liebig.)

An aqueous Solution of Sp. Gr. at 15°	at 25°	Contains Percent of concentrated Sulphuric Acid.
0.998635	0.995478	0
	1.011532	2.5
1.028375	1.027204	5
1.065856	1.060449	10
1.099755		15
1.137816	1.131126	20
1.176687		25
1.215421	1.207842	30
1.256211		35
1.297562	1.286807	40
1.340860		45
1.386607	1.377973	50
1.434725		55
1.486006	1.476711	60
1.540191		65
1.594626	1.586291	70
1.653449		75
1.709026	1.699580	80
1.760161		85
1.804971	1.793986	90
1.831763		95
1.840556	1.828646	100

(Delezenne, from *Recueil des travaux de la Soc. de Sci. Agric. et Arts, de Lille*, 1823–1824, p. 1, in *Férussac's Bulletin*, 1827, **8.** 133.)

Quantities of monohydrated Acid (HO, SO_3) *in aqueous Sulphuric Acid.*

Sp. Gr. at 0°.	HO, SO_3 percent.	Sp. Gr. at 0°.	HO, SO_3 percent.
1.000	0	1.336	42.2*
1.028	3.86*	1.362	45.
1.035	5.	1.399	48.9*
1.051	7.1*	1.410	50.
1.073	10.	1.460	55.
1.086	11.7*	1.475	56.4
1.112	15.	1.514	60.
1.131	17.5*	1.553	63.4*
1.151	20.	1.570	65.
1.162	21.4*	1.581	66.
1.192	25.	1.593	67.
1.232	30.	1.600	67.6*
1.250	32.2*	1.605	68.
1.274	35.	1.608	68.2*
1.317	40.	1.617	69.

Sp. Gr. at 0°.	HO, SO_3 percent.	Sp. Gr. at 0°.	HO, SO_3 percent.
1.628	70.	1.781	83.
1.632	70.3*	1.791	84.
1.640	71.	1.792	84.1*
1.643	71.3*	1.800	85.
1.648	71.7*	1.808	86.
1.652	72.	1.813	86.6*
1.663	72.9*	1.816	87.
1.664	73.	1.823	88.
1.666	73.1*	1.828	88.4*
1.6675	73.3*	1.830	89.
1.676	74.	1.836	90.
1.6775	74.2*	1.841	91.
1.685	74.7*	1.845	92.
1.688	75.	1.848	93.
1.6935	75.5*	1.8495	93.5*
1.700	76.	1.850	94.
1.712	77.	1.851	94.5*
1.724	78.	1.852	95.
1.729	78.4*	1.853	96.
1.736	79.	1.8545	97.*
1.748	80.	1.855	98.
1.750	80.2*	1.856	98.5*
1.759	81.	1.8564	99.
1.770	82.	1.857	100.

The following data are given for the purpose of correcting observations made at any temperature above 0°.

Sp. Gr. of the acid at 0° C.	Decrease of the sp. gr. by a rise of temperature = 10° C. or 18° F.
1.04	0.002
1.07	0.003
1.10	0.004
1.15	0.005
1.20	0.006
1.30	0.007
1.45	0.008
1.70	0.009
1.85	0.0096

(Bineau, *Ann. Ch. et Phys.*, (3.) **24.** 337.)

[* The numbers marked with a star are those which were determined by direct experiment.]

From Bineau's data, Otto has calculated the following table for the temperature of 15° C.

Percent of monohydrated acid, HO, SO_3.	Sp. gr. at 15°.	Percent of anhydrous acid, SO_3.
100	1.8426	81.63
99	1.8420	80.81
98	1.8406	80.00
97	1.8400	79.18
96	1.8384	78.36
95	1.8376	77.55
94	1.8356	76.73
93	1.8340	75.91
92	1.8310	75.10
91	1.8270	74.28
90	1.8220	73.47
89	1.1860	72.65
88	1.8090	71.83
87	1.8020	71.02
86	1.7940	70.10
85	1.7860	69.38
84	1.7770	68.57
83	1.7670	67.75
82	1.7560	66.94
81	1.7450	66.12
80	1.7340	65.30
79	1.7220	64.48
78	1 7100	63.67
77	1.6980	62.85
76	1.6860	62.04
75	1 6750	61.22
74	1.6630	60.40
73	1.6510	59.59
72	1.6390	58.77
71	1.6370	57.95
70	1.6150	57.14
69	1.6040	56.32
68	1.5920	55.59
67	1.5800	54.69
66	1.5780	53.87
65	1.5570	53.05
64	1.5450	52.24
63	1.5340	51.42
62	1.5230	50.61
61	1.5120	49.79
60	1.501	48.98
59	1.490	48.16
58	1.480	47 34
57	1.469	46.53
56	1.4586	45.71
55	1.448	44.89
54	1.438	44.07
53	1.428	43.26
52	1.418	42.45
51	1.408	41.63
50	1.398	40.81
49	1.3886	40.00
48	1.3790	39.18
47	1.3700	38.36
46	1.3610	37.55
45	1.3510	36.73
44	1.3420	35.82
43	1.3330	35.10
42	1.3240	34 28
41	1.3150	33.47
40	1.3060	32.65
39	1.2976	31.83
38	1.2890	31.02
37	1.2810	30.20
36	1.2720	29.38
35	1.2640	28.57
34	1.2560	27.75
33	1.2476	26.94
32	1.2390	26.12
31	1.231	25 30
30	1.223	24.49
29	1.215	23.67
28	1.2066	22.85
27	1.1980	22.03
26	1.1900	21.22
25	1.1820	20.40
24	1.1740	19.58
23	1.1670	18.77
22	1.1590	17.95
21	1.1516	17.14
20	1.1440	16.32
19	1.1360	15.51
18	1.1290	14.69
17	1.1210	13.87
16	1.1136	13.06
15	1.1060	12.24
14	1.0980	11.42
13	1.0910	10.61
12	1.0830	9.79
11	1.0756	8.98
10	1.0680	8.16
9	1.0610	7.34
8	1.0536	6.53
7	1.0464	5.71
6	1.0390	4.89
5	1.0320	4.08

Percent of monohydrated acid, HO, SO_5.	Sp. gr. at 15°.	Percent of anhydrous acid, SO_3.
4	1.0256	3.260
3	1.0190	2.445
2	1.0130	1.630
1	1.0064	0.816

Gerlach (in his *Sp. Gew. der Salzlœsungen*, p. 38) has calculated the following table from Bineau's data.

A solution of sp. gr. at 15°.	Contains Percent of HO, SO_3.	Contains Percent of SO_3.	Formula.
1.8426	100.	81.633	HO, SO_3
1.779	84.483	68.965	$2HO, SO_3$
1.652	73.137	59.701	$3HO, SO_3$
1.552	64.474	52.632	$4HO, SO_3$
1.477	57.647	47.059	$5HO, SO_3$
1.419	52.128	42.553	$6HO, SO_3$
1.376	47.572	38.835	$7HO, SO_3$
1.339	43.661	35.714	$8HO, SO_3$
1.310	40.495	33.057	$9HO, SO_3$
1.286	37.693	30.769	$10HO, SO_3$

Sp. Gr.	Percentage of SO_3	Percentage of HO, SO_3
1.8485	81.54	100
1.8460	79.90	98
1.8410	78.28	96
1 8336	76.65	94
1.8233	75.02	92
1.8115	73.39	90
1.7962	71.75	88
1.7774	70.12	86
1.7570	68.49	84
1.7360	66.86	82
1.7120	65.23	80
1.6870	63 60	78
1.6630	61.97	76
1.6415	60.34	74
1.6204	58.71	72
1.5975	57.08	70
1.5760	55.45	68
1.5503	53.82	66
1.5280	52.18	64
1.5066	50.55	62
1.4860	48.92	60
1.4660	47.29	58
1.4460	45.66	56
1.4265	44.03	54
1.4073	42.40	52
1.3884	40.77	50
1.3697	39.14	48
1.3530	37.51	46
1.3345	35.88	44
1.3165	34.25	42
1.2999	32.61	40
1.2826	30.98	38
1.2654	29.35	36
1.2490	27.72	34
1.2334	26.09	32
1.2184	24.46	30
1.2032	22.83	28
1.1876	21.20	26
1.1706	19.57	24
1.1549	17.94	22
1.1410	16.31	20
1.1246	14.68	18
1.1090	13.05	16
1.0953	11.41	14
1.0809	9.78	12
1.0682	8.15	10
1.0544	6.52	8
1.0405	4.89	6
1.0268	3.26	4
1.0140	1.63	2

(Ure, *Schweigger's Journ. Ch. u. Phys.*, **35.** 444; and *Gmelin's Handbook*, **2.** 137. Compare Langberg's remarks in *Report of the 17th meeting of the British Association*, Oxford, 1847, p. 1.)

Sp. Gr.	Percent HO, SO_3.
1.842	100
1.725	84.22
1.618	74.32
1.524	66.45
1.466	58.02
1.375	50.41
1.315	43.21
1.260	36.52
1.210	30.12
1.162	24.01
1.114	17.39
1.076	11.73
1.023	6.60

(Vauquelin, *Ann. Chim.*, **76.** 260; in *Gmelin's Handbook*, **2.** 186.)

Sp. Gr. (at 15.56°).	Percent of SO_3	Boiling point.
1.850	81	326.66°
1.849	80	318.33°
1.848	79	310°
1.847	78	301.66°
1.845	77	293.33°
1.842	76	285°
1.838	75	276.66°
1.833	74	268.33°
1.827	73	260.56°
1.819	72	252.78°
1.810	71	245°
1.801	70	237.78°
1.791	69	230.56°
1.780	68	223.89°
1.769	67	216.33°
1.757	66	210°
1.744	65	204.44°
1.730	64	199.44°
1.715	63	194 44°
1.699	62	190°
1.684	61	186.11°
1.670	60	182.33°
1.650	58.6	176.66°
1.520	50	143.33°
1.408	40	126.66°
1.30+	30	115.56°
1.200	20	106.66°
1.10—	10	103.33°

(Dalton, in his *New System*, Pt. **2.** p. 404.)

Sp. Gr.	Percent of HO, SO_3
1.844	100
1.717	82.34
1.618	74.32
1.603	72.70
1.586	71.17
1.566	69.30
1.550	68.03
1.532	66.45
1.515	64.37
1.500	62.80
1.482	61.32
1.466	59.85
1.454	58.02

(Darcet, *Ann. Ch. et Phys.*, (1.) **1.** 198; and *Gmelin's Handbook*, **2.** 186.)

Table by which to prepare sulphuric acid of any desired strength, by mixing the acid of 1.86 *sp. gr. with water.*

100 pts. of water at 15° @ 20° being mixed with pts. of sulphuric acid of 1.86 sp. gr.	Gives an acid of sp. gr.
1	1.009
2	1.015
5	1.035
10	1.060
15	1.090
20	1.113
25	1.140
30	1.165
35	1.187
40	1.210
45	1.229
50	1.248
55	1.265
60	1.280
65	1.297
70	1.312
75	1.326
80	1.340
85	1.357
90	1.372
95	1.386
100	1.398
110	1·420
120	1·438
130	1·456
140	1·473
150	1·490
160	1·510
170	1·530
180	1·543
190	1·556
200	1·568
210	1·580
220	1·593
230	1·606
240	1·620
250	1·630
260	1·640
270	1·648
280	1·654
290	1·667
300	1·678
310	1·689
320	1·700
330	1·705
340	1·710
350	1·714
360	1·719
370	1·723
380	1·727
390	1·730
400	1·733
410	1·737
420	1·740
430	1·743
440	1·746
450	1·750
460	1·754
470	1·757
480	1·760
490	1·763
500	1·766
510	1·768
520	1·770
530	1·772
540	1·774
550	1·776
560	1·777
580	1·778
590	1·780
600	1·782

(Anthon.)

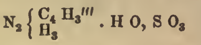
For experiments and observations, by Meissner and Gerlach, on the varying sp. gr. of sulphuric acid, according as it is prepared from sulphate of iron (Nordhausen acid), or from sulphur (English acid), see Gerlach's *Sp. Gew. der Salzlœsungen*, pp. 35, 37.

When equal weights of concentrated sulphuric acid and alcohol of 0.82 sp. gr. are mixed, at the ordinary temperature, heat is evolved, and a considerable amount of ethylsulphuric acid formed. (Hennel, *Phil. Trans.*, 1826, **116.** 246.)

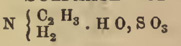
The normal salts of sulphuric acid, *i. e.* those of the formula $M\,O,\,S\,O_3$, are mostly soluble in water, excepting the lime, and silver salts, which are sparingly, and the baryta, lead, and strontia salts scarcely at all soluble. Several of them are soluble in glycerin. As a rule, they are all insoluble, or very slightly soluble, in alcohol or wood-spirit.

In presence of free sulphuric acid their solubility in water is but little augmented. (Dumas, *Tr.*) The bi- or tersulphates ($M\,O,\,2\,S\,O_3$, and $M\,O,\,3\,S\,O_3$) are either soluble in water, or they are resolved by it into free sulphuric acid and a normal salt. The basic sulphates are usually insoluble in water, but soluble in dilute chlorhydric acid. Alkaline sulphates crystallize partially from aqueous solutions of cane-sugar when they are present in large quantity, but a portion remains with the sugar as a slimy mass. (Hochstetter, *J. pr. Ch.*, 1843, **29.** 29.)

SULPHATE OF ACEDIAMIN. Easily soluble in water. Sparingly soluble in boiling ordinary alcohol. (Strecker, *Ann. Ch. u. Pharm.*, **103.** 329.)


$N_2\left\{\begin{matrix}C_4\,H_3'''\\H_3\end{matrix}\right.\,.\,H\,O,\,S\,O_3$

SULPHATE OF ACETOSAMIN (Acetoylamin). Soluble in water. Sparingly soluble, or insoluble, in alcohol.


$N\left\{\begin{matrix}C_2\,H_3\\H_2\end{matrix}\right.\,.\,H\,O,\,S\,O_3$

SULPHATE OF AGROSTEMMIN. Easily soluble in boiling water; still more soluble in alcohol.

SULPHATE OF ALANIN. Very soluble in water. [Sparingly ?] soluble in alcohol. It is precipitated as a syrup on the addition of a mixture of alcohol and ether to its solutions.

SULPHATE OF ALUMINA.

I.) *normal.* $Al_2\,O_3,\,3\,S\,O_3 + 18\,Aq$ Permanent. Soluble in 2 pts. of cold water, the saturated solution containing 33.33% of it. (Berzelius.) Deliquescent. Soluble in less than 1 pt. of water. (Dumas, *Tr.*) The salt is not at all deliquescent, but after having been pulverized will not remain in this condition, undergoing "regelation," as it were. (Ordway.)

100 pts. of water at °C	Dissolve pts. of the anhydr. salt, $Al_2\,O_3,\,3\,S\,O_3$.	 pts. of the cryst. salt, $Al_2\,O_3,\,3\,S\,O_3 + 18\,Aq$.
0°	31.30	86.85
10°	33.50	95.80
20°	36.15	107.35
30°	40.36	127.63
40°	45.73	167.65
50°	52.13	201.36
60°	59.09	262.63
70°	66.23	348.18
80°	73.14	467.30
90°	80.83	678.81
100°	89.11	1131.98

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** 467.)

Scarcely at all soluble, or insoluble, in alcohol. (Berzelius.) Sulphate of alumina may be completely precipitated from its aqueous solution by adding a suitable quantity of glacial acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836. (2.) **63.** 444).

Crystallizes from its solution in chlorhydric acid. (Kane.)

II.) *monobasic.* $Al_2O_3, SO_3 + 9\ Aq$ Nearly insoluble in water. Easily soluble in chlorhydric acid. It occurs also native, as Alumininite.

III.) *bibasic.* $2\ Al_2O_3; SO_3 + 10\ Aq$ Insoluble in water. While moist it is soluble in cold acetic acid, as well as in the mineral acids. (Crum, *Ann. Ch. u. Pharm.*, **89.** 174.)

Ordway (*Am. J. Sci.*, (2.) **26.** 203) obtained a "bibasic" sulphate of alumina soluble in water. According to him all the compounds which contain more base than this are insoluble in water. The "terbasic" sulphate is soluble in acetic acid, this solution being the "red-mordant" of calico printers. (*loc. cit.*, p. 204.)

IV.) *biacid.* $Al_2O_3, 2\ SO_3$ Soluble in water. Decomposed by much water, or by boiling the aqueous solution, to an insoluble basic sulphate and ordinary tersulphate which remains dissolved.

V.) $2\ Al_2O_3, 3\ SO_3$ Soluble in a small quantity of water, but, like No. IV. [and all the soluble compounds containing less acid than the normal salt ($Al_2O_3, 3\ SO_3$)], it is decomposed by a large quantity of water, or by boiling its aqueous solution. (Maus.)

VI.) $3\ Al_2O_3, 4\ SO_3 + 30\ Aq$ Soluble in 144 pts. of cold, and in 30.8 pts. of boiling water. Easily soluble in chlorhydric and nitric acids. (Rammelsberg.)

When hydrate of alumina is dissolved in moderately dilute sulphuric acid, and this solution diluted with water, a muddy basic salt deposits itself continually for months, and the filtrate from this will deposit still more if it be heated. (Phillips; Gay-Lussac.)

Sulphate of Alumina & of Ammonia.

I.) Equally soluble with potash alum, in water. (*Ammonia Alum.*) $NH_4O, SO_3; Al_2O_3, 3\ SO_3 + 24\ Aq$ (Pelouze & Fremy.) Somewhat more soluble than potash alum in water. (Otto Graham.) Soluble in 11.444 pts. of water at 17.5°; or, 100 pts. of water dissolve 8.738 pts. of it at 17.5°. (Pohl, *Wien. Akad. Bericht*, **6.** 597.)

Its solubility is less at all temperatures than that of either of its component salts. (Poggiale, *loc. inf., cit.*)

100 pts. of water at °C.	Dissolve of the anhydrous alum, pts.	Dissolve of the crystallized alum, pts.
0°	2.62	5.22
10°	4.50	9.16
20°	6.57	13.66
30°	9.05	19.29
40°	12.35	27.27
50°	15.90	36.51
60°	21.09	51.29
70°	26.95	71.97
80°	35.19	103.08
90°	50.30	187.82
100°	70.83	421.90

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** 467.)

100 pts. of water at 15.5° dissolve 9.37 pts. of the crystallized alum; but it is much more soluble in boiling water. (Thomson's *System of Chem.*, London, 1831, **2.** 752.)

II.) *basic.* When ammonia-water is added by small portions to an aqueous solution of ammonia-alum the precipitate which at first forms is redissolved until the solution contains $2\ (NH_4O, SO_3); 2\ Al_2O_3, 3\ SO_3$, but the solution is decomposed by boiling, and when diluted with much water. If ammonia be added until a permanent precipitate is formed this is composed (according to Riffault) of $NH_4O, SO_3; 3(Al_2O_3, SO_3) + 9\ Aq$. (Berzelius's *Lehrb.*)

Sulphate of Alumina, of Ammonia, & of Chromium. $Al_2O_3, 3\ SO_3; Cr_2O_3, 3\ SO_3; 2\ (NH_4O, SO_3) + 48\ Aq$ Soluble in water, the solution undergoing decomposition when boiled. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 71.)

Sulphate of Alumina, of Chromium, & of Potash. $Al_2O_3, 3\ SO_3; Cr_2O_3, 3\ SO_3; 2\ (KO, SO_3) + 48\ Aq$ Soluble in water, the solution undergoing decomposition when boiled. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 70.)

Sulphate of Alumina & of Coniin.

Sulphate of Alumina & of Ethylamin. $N \left\{ {C_4H_5 \atop H_2} \right. . HO, SO_3; Al_2O_3, 8\ SO_3 + 24\ Aq$ Soluble in 6.89 pts. of water at 25°. (Stenner & Kaumer.)

Sulphate of Alumina & *of protoxide* of Iron.

I.) Soluble in water. (Klauer.)
$FeO, SO_3; Al_2O_3, 3\ SO_3 + 24\ Aq$

II.) Soluble in water. (Berthier.)
$2\ (FeO, SO_3); Al_2O_3, 3\ SO_3 + 27\ Aq$

III.) Easily soluble in water. (Phillips.)
$6\ (FeO, SO_3); Al_2O_3, 2\ SO_3 + 48\ Aq$

Sulphate of Alumina & *of sesquioxide* of Iron.

I.) *basic.* Easily soluble in cold dilute sulphuric acid, difficultly soluble in cold dilute nitric or chlorhydric acids. (Anthon.)

Sulphate of Alumina, *of protoxide* of Iron, & of Magnesia.
$FeO, SO_3; MgO, SO_3; Al_2O_3, SO_3 + 15\ Aq$

Sulphate of Alumina, of Iron, & of Potash. $Al_2O_3, 3\ SO_3; 12\ (FeO, SO_3); 2\ (KO, SO_3) + 25\ Aq$ Difficultly soluble in water. Permanent. (Dufresnoy.)

Sulphate of Alumina & of Lithia. $LiO, SO_3; Al_2O_3, 3\ SO_3 + 24\ Aq$ Permanent. Soluble in 24 pts. of cold, and in 0.87 pt. of hot water. (Kralovansky.)

[Rammelsberg doubts the existence of this salt. Neither Arfvedson nor C. Gmelin could obtain a Lithia alum.]

Sulphate of Alumina, of Lithia, & of Potash. Soluble in water, from which it crystallizes readily when the hot solution is cooled. (Joss, *J. pr. Ch.*, 1834, **1.** 142, *note.*)

Sulphate of Alumina & of Magnesia. (*Magnesia Alum.*)

I.) $MgO, SO_3; Al_2O_3, 3\ SO_3 + 25\ Aq$

II.) $3\ (MgO, SO_3); Al_2O_3, 3\ SO_3 + 36\ Aq$

Sulphate of Alumina, of Magnesia, & of Manganese. $MgO, SO_3; MnO, SO_3; Al_2O_3, 3\ SO_3 + 25\ Aq$ As soluble as common potash alum. (Apjohn; Kane.)

A sample examined by Lawrence Smith (*Am. J. Sci.*, 1854, (2.) **18.** 379, of composition $(Mg, Mn)\ O, SO_3; Al_2O_3, 3\ SO_3 + 24\ Aq$, was "very readily soluble in water; in fact, so soluble that it was difficult to decide the amount of water requisite for its complete solution."

SULPHATE OF ALUMINA & OF MANGANESE. $MnO, SO_3; Al_2O_3, 3SO_3 + 25 Aq$ As soluble as common potash alum. (Apjohn, *Rep. Br. Assoc.*, 1837, p. 49.) Easily soluble in water. (Berzelius, *Lehrb.*)

SULPHATE OF ALUMINA & OF METHYLAMIN. $N\left\{\begin{matrix}C_2H_3\\H_2\end{matrix}\right. . HO, SO_3; Al_2O_3, 3SO_3 + 24 Aq$ Soluble in water. (v. Alth.)

SULPHATE OF ALUMINA & OF *tri*METHYLAMIN. $N\left\{(C_2H_3)_3\right. . HO, SO_3; Al_2O_3, 3SO_3 + 24 Aq$ Very soluble in water.

SULPHATE OF ALUMINA & *of binoxide* OF PLATINUM. Insoluble in water, or cold mineral acids. Very slightly soluble in hot acids. (E. Davy.)

SULPHATE OF ALUMINA & OF POTASH. (*Potash Alum. Common Alum.*)

I.) *normal.* Permanent, or slightly efflorescent. $KO, SO_3; Al_2O_3, 3SO_3 + 24 Aq$ Very slowly soluble in cold water. Burnt (*i. e.* dehydrated) alum dissolves very slowly: — if thrown into water immediately after having been dried and cooled, it will remain undissolved for months, but if it is exposed to the air for a fortnight before being treated with water, it will dissolve readily. (Geiger, *Mag. Pharm.*, **8.** 199.) 100 pts. of the saturated aqueous solution contain at the boiling point (104.4°) 52 pts. of dry alum, *i. e.* 100 pts. of water dissolve 108.33 pts. of it at 104.4°; or, in other words, 1 pt. of dry alum is soluble in 0.923 pt. of water at 104.4°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.)

100 pts. of water at °C.	Dissolve of anhydrous potash alum, pts.	Dissolve of crystallized potash alum, pts.
0°	2.10	3.90
10°	4.99	9.52
20°	7.74	15.13
30°	10.94	22.01
40°	14.88	30.92
50°	20.09	44.11
60°	26.70	66.65
70°	35.11	90.67
80°	45.66	134.47
90°	58.68	209.31
100°	74.53	357.48

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** 467.)

The solubility of potash alum is at all temperatures less than that of its component salts. (Poggiale, *loc. cit.*)

Soluble in	13.286	pts. of water at	12.5°
"	8.2	"	21.25°
"	4.5	"	25°
"	2.2	"	37.5°
"	2.01	"	50°
"	0.4	"	62.5°
"	0.11	"	75°
"	0.06	"	87.5°

Or, 100 pts. of water at °C.	Dissolve pts. of $KO, SO_3; Al_2O_3, 3SO_3 + 24 Aq.$
12.5°	7.6
21.25°	10.4
25°	22.
37.5°	44.1
50°	46.7 [*not* "41."]
62.5°	230.
75°	920.
87.5°	1566.6

Or, the aqueous solution saturated at °C.	Contains percent of $KO, SO_3; Al_2O_3, 3SO_3 + 24 Aq.$
12.5°	7.
21.25°	9.5
25°	18.
37.5°	31.
50°	31.84
62.5°	70.
75°	90.2
87.5°	94.

When heated, alum begins to melt, in its water of crystallization, at 87.5°, and is completely liquid at 92.5° @ 93.75°, hence the statements of previous observers, that it requires for its solution 0.75 pt., or, as some say, 2 pts. of water at the temperature of boiling, must be erroneous. (R. Brandes, *Brandes's Archiv.*, 1822, **2.** 339 and fig.)

[Most of Brandes's determinations were probably made upon *supersaturated* solutions, since his method of preparing the latter was favorable for the development of this phenomenon, for which he makes no allowance.] Soluble in 18 pts. of cold, and in 1.6 pts. of boiling water (Fourcroy); in 14.12 pts. of water at a moderate heat, and in 0.75 pt. of boiling water. (Bergman, *Essays*, **1.** pp. 350, 366, 368, 181.) [On page 181 of B.'s *Essays* is printed, apparently by error, "1 pt. of alum requires [for its solution] 30 pts. of water in a moderate heat."] Crystallized alum is soluble in 15 pts. of water at the ordinary temperature, and in 0.75 pt. of boiling water. (Dumas, *Tr.*) Soluble in 18.363 pts. of cold, and in 0.75 pt. of boiling water, the saturated cold solution containing 5.16% of it, and the boiling saturated solution 57.14%. (M. R. & P.) Soluble in 11.7 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 76.)

100 pts. of water at °C.	Dissolve of crystallized potash alum, pts.
15.56°	14.79
100°	133.33 [T.]
15.56°	8.7
100°	75. (?)

(Ure's *Dict.*)

The aqueous solution saturated at 15° is of 1.048774 sp. gr., and contains dissolved in every 100 pts. of water at least 10.939 pts. of alum. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) The aqueous solution saturated "in the cold" contains 5.2% of it (Fourcroy); at 38° (of B's therm.) 6.7% (Bœrhave); at 10° (C.) 25.8(?)% (Eller); and at 12.5° 5.5% (Hassenfratz, *Ann. de Chim.*, **28.** 291.)

Warm solutions of alum are liable to become supersaturated on cooling. (Coxe.) Solutions of alum not too highly charged with the salt may be preserved for a long time in a supersaturated state, if they are allowed to cool in close vessels out of contact with the air [or in vessels loosely stopped with cotton-wool, so that the air may be filtered. (Schrœder, *Ann. Ch. u. Pharm.*, 1859, **109.** 45.)]. If such solutions be exposed to cold of +5° @ —3° they usually crystallize as ordinary alum, but sometimes in rhombohedrons, or in tables. This tabular variety has a very great solubility. Mother liquors, from which it had been deposited, contained, at 0°, 180 pts. of ordinary alum in 100 pts. of water. When heated to 100° in a closed tube, alum dissolves completely in its water of crystallization. (Lœwel, *Ann. Ch. et Phys.*, (3.) **43.** 414.) Ordinary alum melts in its water of crystallization when heated to 92°, and on cooling this solution it remains liquid for a long time before solidifying. (Berzelius, *Lehrb.*) Insoluble in spirit of 0.905, or less, sp. gr. (Anthon, *J. pr. Ch.*, **14.** 125.) Nearly insoluble in an aqueous solution of tersulphate of alumina. (Geiger.) Insoluble in a saturated aqueous solution of tersulphate of alumina. (W. Crum, *Ann. Ch. u. Pharm.*, **89.** 156.) The aqueous solution saturated at 8° is of 1.045 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24.** 210.)

An aqueous solution of sp. gr., at 12.5°	Contains percent of alum.
1.0047	1
1.0094	2
1.0142	3
1.0189	4
1.0236	5

(Hassenfratz, *Ann. de Chim.*, **28.** 296.)

When a solution of alum is treated with a large excess of concentrated sulphuric acid, this combines with the water, and acicular crystals of alum separate out. (Baron, 1744, cited in Bergman's *Essays*, **1.** 378.) But in dilute sulphuric or other acid it is more readily soluble than in water. (Bergman, *Ibid.*, p. 379.) When boiled with a saturated aqueous solution of chloride of potassium, chlorhydric acid is formed, and a subsulphate of alumina falls down; this occurs only to a small extent with chloride of sodium, and still less with chloride of ammonium. (Ure's *Dict.*)

II.) *basic.* Insoluble in water, but after having been gently ignited water removes ordinary alum, while the excess of alumina remains undissolved.

$K O, S O_3 ; 3 (Al_2 O_3, S O_3) + 9 Aq$

SULPHATE OF ALUMINA & OF SODA. When pure it is permanent, but effloresces on the surface when impure. (Thompson.) Soluble in 2.14 pts. of water at 13°, and in 1 pt. of boiling water. (Zellner.) Soluble in 0.909 pt. of water at 16°, the saturated solution containing 52.38% of it. (Berzelius, *Lehrb.*) 100 pts. of water at 15.5° dissolve 327.6 pts. of it. (Thomson, in his *System of Chem.*, London, 1831, **2.** 766.) 100 pts. of water at 15.5° dissolve 110 pts. of it, forming a liquor of 1.296 sp. gr. (Ure.) Insoluble in absolute alcohol. (Zellner.)

(*Soda-Alum.*)
$Na O, S O_3 ; Al_2 O_3, 3 S O_3 + 24 Aq$

SULPHATE OF ALUMINA & OF ZINC.

(*Zinc-Alum.*)
$Zn O, S O_3 ; Al_2 O_3, 3 S O_3 + 24 Aq$

SULPHATE OF AMARIN. Soluble in alcohol.

SULPHATE OF AMIDOBENZOIC ACID. *Vid.* Sulphate of Benzamic Acid.

SULPHATE OF *bi*AMIDOBENZOIC ACID. Readily soluble in water; somewhat less soluble in alcohol. Both of these solutions are easily decomposed. (Voit.)

$N_2 C_{14} H_8 O_4, 2 H O, 2 S O_3$

SULPHATE OF *bi*AMIDOBENZYLENE. *Vid.* SulphoBenzamid.

SULPHATE OF AMMOLIN (of Unverdorben). Very readily soluble in water, and alcohol. Insoluble in ether.

"SULPHATE OF AMMON," &c. *Vid.* Sulphamid.

(Compounds of $N H_3$ & $S O_3$)

SULPHATE OF AMMONIA.

I.) *normal.* Somewhat hygroscopic. Soluble in 1.3 pts. of water at the ordinary temperature. (A. Vogel, Jr.) Soluble in 1.31 pts. of water at 19°, or 100 pts. of water at 19° dissolve 76.1 pts. of it, or the aqueous solution saturated at 19° contains 43.2% of it, and is of 1.2491 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.) Soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht, für* 1854, p. 76.) Soluble in 2 pts. of water at 15.5°, and in 1 pt. of boiling water (Fourcroy), the solution saturated at 15.5° containing 33.33% of it; that saturated at 10° containing 30.4% of it (Eller), and the boiling saturated solution 50% of it. 100 pts. of water at 62.6° dissolve 78 pts. of it. (Wenzel, p. 309 [T.].) The aqueous solution saturated at 15° is of 1.248215 sp. gr., and contains dissolved in every 100 pts. of water at least 66.739 pts. of it. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) When treated with boiling water a small quantity of ammonia is evolved, and the solution obtained exhibits an acid reaction. (Emmet, *Am. J. Sci.*, (1.) **18.** pp. 255, 256.)

$N H_4 O, S O_3$

An aqueous solution of sp. gr. (at 19°).	Contains (by experiment) percent of $N H_4 O, S O_3$.
1.2491	43.19
1.1655	28.81
1.1100	19.20
1.0829	14.40
1.0556	9.60
1.0275	4.80

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 337.)

From these results Schiff calculates the following table by means of the formula: $D = 1 + 0.005757 p - 0.00000148 p^2 + 0.0000000391 p^3$, in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 19°).	Percent of $N H_4 O, S O_3$.	Sp. gr. (at 19°).	Percent of $N H_4 O, S O_3$.
1.0057	. . 1	1.1496	. . 26
1.0115	2	1.1554	27
1.0172	3	1.1612	28
1.0230	4	1.1670	29
1.0287	5	1.1724	30
1.0345	6	1.1780	31
1.0403	7	1.1836	32
1.0460	8	1.1892	33
1.0518	9	1.1948	34
1.0575	10	1.2004	35
1.0632	11	1.2060	36
1.0690	12	1.2116	37
1.0747	13	1.2172	38
1.0805	14	1.2228	39
1.0862	15	1.2284	40
1.0920	16	1.2343	41
1.0977	17	1.2402	42
1.1035	18	1.2462	43
1 1092	19	1.2522	44
1.1149	20	1.2583	45
1.1207	21	1.2644	46
1.1265	22	1.2705	47
1.1323	23	1.2766	48
1.1381	24	1.2828	49
1.1439	. . 25	1.2890	. . 50

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110.** 74.)

Tolerably soluble in alcohol, the sp. gr. of which is greater than 0.860. Insoluble in alcohol of sp. gr. less than 0.850. (Berzelius.) 1000 pts. of alcohol, of 0.872 sp. gr., dissolve 6 pts. of the salt, and that of 0.905 sp. gr. 11 pts. (Berzelius, *Lehrb.*, **3.** 297.) Soluble in 217.4 pts. of alcohol of 66.8% at 24.3°; or 100 pts. of this alcohol dissolve 0.46 pt. of the salt at 24.3°. (Pohl, *Wien. Akad. Bericht*, **6.** 599.) 500 pts. of alcohol of 0.872 dissolve 1 pt.; and 1000 pts. of spirit of 0.905 dissolve 16 pts. of it. (Anthon, from *Buchner's Repert.*, **2.** pp. 13, 18; in *J. pr. Ch.*, **14.** 125.) Soluble, with decomposition, in chlorhydric acid.

II.) *bi.* $NH_4O, HO, 2SO_3$ Deliquescent. Soluble in 1 pt. of cold water. (Link.) Very sparingly soluble in alcohol. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **20.** 255.)

III.) *sesqui.* $3NH_4O, HO, 2SO_3$ Very easily soluble in water. (Berzelius, *Lehrb.*, **3.** 297.)

Sulphate of Ammonia & of Cadmium. $NH_4O, SO_3; CdO, SO_3 + 6\,Aq$

Sulphate of Ammonia & *of protoxide* of Cerium. Easily soluble in pure water. (Beringer.)

Sulphate of Ammonia & *of sesquioxide* of Chromium.

a = violet modif. *(Ammonia Chrome Alum.)* $NH_4O, SO_3; Cr_2O_3, 3SO_3 + 24\,Aq$ Superficially efflorescent. Soluble in water, from which it is precipitated on the addition of alcohol. (Schrœtter.)

Less soluble in water than the potash-salt, and is consequently much more easily crystallized. From a concentrated aqueous solution of violet sulphate of sesquioxide of chromium, ammonia-chrome alum is precipitated on the addition of a concentrated solution of sulphate of ammonia. When the aqueous solution is heated to 75° the green modification (compare Sulphate of Chromium & of Potash) is produced. Melts in its water of crystallization at 100°. (Berzelius's *Lehrb.*, **3.** 1083.)

b = green modif.

I.) *anhydrous.*

II.) *hydrated.* Soluble in water, and alcohol. $NH_4O, SO_3; Cr_2O_3, 3SO_3 + 6\,Aq$ When the aqueous solution is allowed to stand for 10 @ 12 days it changes to the violet modification.

Sulphate of Ammonia & of Cobalt. $NH_4O, SO_3; CoO, SO_3 + 6\,Aq$

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	8.9
10°	11.6
18°	15.2
23°	17.1
35°	19.6
40°	22.3
45°	25.0
50°	28.7
60°	34.5
75°	43.3

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

Considerably more soluble in water than the corresponding nickel salt. The aqueous solution saturated (slightly supersaturated), at

20° contains 14.927% of the anhyd. salt.
40° " 20.782 " "
60° " 25.579 " "
80° " 32.988 " "

(C. v. Hauer, *J. pr. Ch.*, 1858, **74.** 434.)

Alcohol precipitates it from the aqueous solution. (H. Schiff, *Ann. Ch. u. Pharm.*, **107.** 76.)

Sulphate of Ammonia, of Cobalt, & of Copper. $2(NH_4O, SO_3); CoO, SO_3; CuO, SO_3 + 12\,Aq$ Tolerably easily soluble in boiling water, but after the solution has been boiled for a long time a difficultly soluble basic salt is deposited. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 58.)

Sulphate of Ammonia, of Cobalt, & of Iron. $2(NH_4O, SO_3); CoO, SO_3; FeO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Cobalt, & of Magnesia. $2(NH_4O, SO_3); CoO, SO_3; MgO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Cobalt, & of Manganese. $2(NH_4O, SO_3); CoO, SO_3; MnO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Cobalt, & of Nickel. $2(NH_4O, SO_3); CoO, SO_3; NiO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Cobalt, & of Zinc. $2(NH_4O, SO_3); CoO, SO_3; ZnO, SO_3 + 12\,Aq$

Sulphate of Ammonia & of Copper. $NH_4O, SO_3; CuO, SO_3 + 6\,Aq$ Effloresces in warm dry air. Soluble in 1.5 pt. of boiling water. Very sparingly soluble in cold water. (A. Vogel.) Soluble in 3.76 pts. of water at 19°; or 100 pts. of water at 19° dissolve 26.6 pts. of it; or an aqueous solution saturated at 19° contains 21% of it, or 14.4% of the anhydrous salt, and is of 1.1336 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.) Soluble in 1.55 pt. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht, für* 1854, p. 76.)

Sulphate of Ammonia, of Copper, & of Iron. $2(NH_4O, SO_3); CuO, SO_3; FeO, SO_3 + 12\,Aq$ Soluble, without decomposition, in water which is free from air. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 61.)

Sulphate of Ammonia, of Copper, & of Magnesia. $2(NH_4O, SO_3); CuO, SO_3; MgO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Copper, & of Manganese. $2(NH_4O, SO_3); CuO, SO_3; MnO, SO_3 + 12\,Aq$

Sulphate of Ammonia, of Copper, & of Nickel. $2(NH_4O, SO_3); CuO, SO_3; NiO, SO_3 + 12\,Aq$

Sulphate of Ammonia. of Copper, & of Zinc. $2(NH_4O, SO_3); CuO, SO_3; ZnO, SO_3 + 12\,Aq$

Sulphate of Ammonium & Cupr(*ic*)ammonium. $N\left\{\begin{matrix}H_3\\Cu\end{matrix}\right. . O, NH_4O, SO_3$ Soluble in 1.5 pt. of cold water. (Kuehn.) When the aqueous solution is exposed to the air (Kuehn), or largely diluted with water, tetra-sulphate of copper ($4CuO, SO_3$) is precipitated. Insoluble in alcohol.

Sulphate of Ammonia & of Didymium. $NH_4O, SO_3; 3(DiO, SO_3) + 8\,Aq$ Soluble in 18 pts. of water; it is a little less soluble in a saturated solution of sulphate of ammonia. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 171.)

Sulphate of Ammonia & *of protoxide* of Iron. $NH_4O, SO_3; FeO, SO_3 + 6\,Aq$ Much less soluble in water than protosulphate of iron ($FeO, SO_3 + 7\,Aq$). (Vogel.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
at 0°	12.2
12°	17.5
20°	21.6
30°	28.1
36°	31.8
45°	36.2
55°	40.3
60°	44.6
65°	49.8
75°	56.7

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

1 pt of the 6 Aq salt is soluble in 2.80 pts. of water at 16.5°; or, 100 pts. of water at 16.5° dissolve 35.9 pts. of it; or the aqueous solution saturated at 16.5° contains 26.4% of it, or 19.1% of the anhydrous salt, and is of 1.1666 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.)

An aqueous solution of sp. gr. (at 16.5°).	Contains (by experiment) percent of $NH_4O, SO_3; FeO, SO_3 + 6 Aq$.
1.1666	26.40
1.1083	17.60
1.0708	11.74
1.0530	8.80
1.0354	5.87

For calculating other values Schiff proposes the formula: $D = 1 + 0.005918\,p + 0.00001083\,p^2 + 0.0000001715\,p^3$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution. (H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 337.)

Sulphate of Ammonia & *of sesquioxide* of Iron.

I.) *normal.* (*Ammonia Iron Alum.*) $NH_4O, SO_3; Fe_2O_3, 3 SO_3 + 24 Aq$ More permanent, more soluble in water, and more easily crystallized than the corresponding potash salt. Soluble in 3 pts. of water at 15°. (Forchammer.)

II.) *basic.* Soluble in 2.4 pts. of cold water. $2 (NH_4O, SO_3); Fe_2O_3, 2 SO_3 + 6 Aq$ (Maus.)

III.) *polybasic.* Very sparingly soluble in concentrated chlorhydric acid. (Berzelius.)

Sulphate of Ammonia, of Iron, & of Magnesia. $2 (NH_4O, SO_3); FeO, SO_3; MgO, SO_3 + 12 Aq$

Sulphate of Ammonia, of Iron, & of Manganese. $2 (NH_4O, SO_3); FeO, SO_3; MnO, SO_3 + 12 Aq$ Tolerably easily soluble in water. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 67.)

Sulphate of Ammonia, of Iron, & of Nickel. $2 (NH_4O, SO_3); FeO, SO_3; NiO, SO_3 + 12 Aq$

Sulphate of Ammonia, of Iron (*protoxide*), & of Zinc. $2 (NH_4O, SO_3); FeO, SO_3; ZnO, SO_3 + 12 Aq$ Tolerably readily soluble in water. (Tassaert, *Ann. Ch. et Phys.*, **24.** 100 [T.].)

Sulphate of Ammonia, of Iron (*sesquioxide*), & of Zinc.

Sulphate of Ammonia & of Lead. $NH_4O, SO_3; PbO, SO_3$ Decomposed by water, which abstracts sulphate of ammonia. (Wœhler.)

Sulphate of Ammonia & of Lithia. $NH_4O, SO_3; LiO, SO_3$ Easily soluble in water. (Arfvedson.)

Sulphate of Ammonia & of Magnesia. $NH_4O, SO_3; MgO, SO_3 + 6 Aq$ Permanent. Less soluble in water than either of the salts of which it is composed. (Graham.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
at 0°	9.0
10°	14.2
15°	15.7
20°	17.9
30°	19.1
45°	25.6
50°	30.0
55°	31 9
60°	36.1
75°	45.3

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)
It is liable to form supersaturated solutions. (Ogden.)

Sulphate of Ammonia, of Magnesia, & of Manganese. $2 (NH_4O, SO_3); MgO, SO_3; MnO, SO_3 + 12 Aq$

Sulphate of Ammonia, of Magnesia, & of Nickel. $2 (NH_4O, SO_3); MgO, SO_3; NiO, SO_3 + 12 Aq$

Sulphate of Ammonia, of Magnesia, & of Zinc. $2 (NH_4O, SO_3); MgO, SO_3; ZnO, SO_3 + 12 Aq$

Sulphate of Ammonia, & *of protoxide* of Manganese. $NH_4O, SO_3; MnO, SO_3 + 6 Aq$ Deliquesces in moist air. Readily soluble in water. (John.)

Sulphate of Ammonia, & *of sesquioxide* of Manganese. $NH_4O, SO_3; Mn_2O_3, 3 SO_3 + 24 Aq$ Soluble in water, with subsequent decomposition. (Mitscherlich.)

Sulphate of Ammonia, *of protoxide* of Manganese, & of Nickel. $2 (NH_4O, SO_3); MnO, SO_3; NiO, SO_3 + 12 Aq$

Sulphate of Ammonia, of Manganese, & of Zinc. $2 (NH_4O, SO_3); MnO, SO_3; ZnO, SO_3 + 12 Aq$

Sulphate of Ammonia, & *of protoxide* of Mercury. $NH_4O, SO_3; HgO, SO_3$ Difficultly soluble in water. Easily soluble in ammonia-water.

Sulphate of Ammonia & of Nickel. $NH_4O, SO_3; NiO, SO_3 + 6 Aq$ Soluble in 1.5 pts. of water. (Wittstein's *Handw.*) Soluble in 4 pts. of cold water. (Link, *Crell's Ann.*, 1796, **1.** 32. [Gm.].) Soluble in 4 pts. of water at 12.5°. (Tupputi, *Ann. de Chim.*, 1811, **78.** 166.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
at 3.5°	1.8
10°	3.2
16°	5.8
20°	5.9
30°	8.3
40°	11.5
50°	14.4
59°	16.7
68°	18.8
85°	28.6

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)
Considerably less soluble in water than the corresponding cobalt salt. The aqueous solution saturated (slightly supersaturated), at

20° contains 9.395% of the anhyd. salt.
40° " 13.153 " "
60° " 18.622 " "
80° " 23.094 " "

(C. v. Hauer, *J. pr. Ch.*, 1858, **74.** 434.)

Sulphate of Ammonia & Nickelammonium. Easily soluble in cold water, the solution undergoing decomposition when boiled. (Erdmann.)

$N\left\{\begin{matrix}H_3\\Ni\end{matrix}\right. O, NH_4O, SO_3 + Aq$

Sulphate of Ammonia, of Nickel, & of Zinc.

$2(NH_4O, SO_3); NiO, SO_3; ZnO, SO_3 + 12 Aq$

Sulphate of Ammonia & *of sesquioxide* of Osmium. Soluble in water. (Berzelius.)

Sulphate of Ammonia & *of binoxide* of Platinum.

I.) *basic.* Insoluble in water. Soluble in warm sulphuric and chlorhydric acids. Decomposed by a boiling solution of caustic potash. (E. Davy.)

Sulphate of Ammonia & of Potash. Permanent. 100 pts. of water at 16° dissolve 13.68 pts. of it. (Thomson's *System of Chem.*, London, 1831, **2.** 750.)

$NH_4O, SO_3; KO, SO_3 + 4 Aq$

Sulphate of Ammonia & of Soda. Permanent. Soluble in water.

$NH_4O, SO_3; NaO, SO_3 + 5 Aq$

Sulphate of Ammonia & *of protoxide* of Uranium. Easily soluble in water. (Rammelsberg.) More readily soluble than the potash salt. On heating the aqueous solution a basic salt separates.

$NH_4O, SO_3; UrO, SO_3 + Aq$

Sulphate of Ammonia & *of sesquioxide* of Uranium. Permanent. Readily soluble in water. (Arfvedson.) Rather sparingly soluble in water. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 43.)

$NH_4O, SO_3; Ur_2O_3, SO_3 + 2 Aq$

Sulphate of Ammonia & of Zinc. Efflorescent. Very soluble in water.

$NH_4O, SO_3; ZnO, SO_3 + 6 Aq$

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	7.3
10°	8.8
13°	10.0
15°	12.5
20°	12.6
30°	16.5
45°	21.7
60°	29.7
75°	37.8
85°	46.2

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

Sulphate of Ammonia & Zincammonium. Efflorescent. Soluble in ammonia-water. (Kane.)

$N\left\{\begin{matrix}H_3\\Zn\end{matrix}\right. O, NH_4O, SO_3 + 2 Aq$

Sulphate of Ammonia & of Zirconia. Soluble in hot, and in cold water; more soluble in water than the corresponding potash salt. Also soluble in acids.

$NH_4O, SO_3; Zr_2O_3, 3SO_3$

Sulphate of AmmonioIridium. Soluble in water. (Claus, *Beiträge*, p. 92.)

$5NH_3 . Ir_2O_3, 3SO_3$

Sulphate of AmmonioRhodium. (Claus, *Beiträge*, p. 89.)

$5NH_3 . Rh_2O_3, 3SO_3 + 3 Aq$

Sulphate of Ammonium ChlorPlatin(*ous*) Ammonium. (*Sulphate of Gros's Base. BiChlorhydrosulfate de diplatinamine.*) Difficultly soluble in cold, tolerably easily soluble in hot water. Decomposed by chlorhydric and nitric acids. (Gros, *Ann. der Pharm.*, 1838, **27.** 251.)

$N_2H_6PtClO, SO_3 = N\left\{\begin{matrix}H_2\\NH_4\\PtCl\end{matrix}\right. . O, SO_3$

Sulphate of Amylamin.

Sulphate of *tetra*Amylammonium.

Sulphate of *di*AmylAnilin. Nearly insoluble in water, or dilute sulphuric acid.

Sulphate of Anilin. Largely soluble in water, especially when this is boiling. The aqueous solution saturated at the boiling temperature becomes solid on cooling. Sparingly soluble in cold, somewhat more soluble in boiling, absolute alcohol. Tolerably readily soluble in dilute alcohol. Insoluble in ether. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 149.)

$N\left\{\begin{matrix}C_{12}H_5\\H_2\end{matrix}\right. . HO, SO_3$

Sulphate of Anilin & of Copper. Decomposed by boiling water.

$N\left\{\begin{matrix}C_{12}H_5\\H\\Cu\end{matrix}\right. . HO, SO_3$

Sulphate of Animin (of Unverdorben). Soluble in water. On boiling the aqueous solution an acid salt is formed, which is soluble in all proportions in water, and alcohol.

Sulphate of Anisamate of Ethyl. Soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 346.)

Sulphate of Anisamic Acid. Easily soluble in water. Very easily soluble in boiling alcohol, from which it separates as the solution cools. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 344.)

$N\left\{\begin{matrix}C_{16}H_7O_4\\H_2\end{matrix}\right. . O_2, HO, SO_3$

Sulphate of Anthranilic Acid.

$N\left\{\begin{matrix}C_2O_2''\\C_{12}H_5\end{matrix}\right. . HO, SO_3 + 2 Aq$

Sulphate of Antimonous Acid.

I.) *di.* Insoluble in warm water. (Péligot.)

$2SbO_3, SO_3$

II.) *mono.* Insoluble in water (Dumas, *Tr.*), or alcohol. (Brandes.) The sulphuric acid may all be abstracted from this salt by boiling water. (Berzelius, *Lehrb.*)

SbO_3, SO_3

III.) *bi.* Decomposed by warm water. Soluble in strong sulphuric acid. (Péligot.)

$SbO_3, 2SO_3$

IV.) *ter.* Soluble in sulphuric acid. Decomposed by water to an insoluble basic, and a soluble acid salt.

$SbO_3, 3SO_3$

V.) *quadri.* Decomposed by warm water. Soluble in strong sulphuric acid. (Péligot, *Ann. Ch. et Phys.*, (3.) **20.** 287.)

$SbO_3, 4SO_3$

Sulphate of Argentammonium. Completely soluble in water. (H. Rose.)

$N\left\{\begin{matrix}H_3\\Ag\end{matrix}\right. . O, SO_3$

Sulphate of Argent*bi*amin. Tolerably permanent. Soluble in warm concentrated ammonia-water, crystallizing out as the solution cools. (Mitscherlich.)

$N_2\left\{H_6\right. . AgO, SO_3$

Sulphate of Aricin.

I.) *normal.* Soluble in boiling water, and in alcohol.

II.) *acid.* Soluble in water.

$N_2\left\{C_{46}H_{26}O_8^{VI}\right. . HO, HO, 2SO_3$

Sulphate of Arsen*di*Ethyl.

Sulphate of ArsenEthylium. Readily soluble in water, and spirit. Sparingly sol-

$As\left\{(C_4H_5)_4\right. . O, HO, 2SO_3$

uble in ether. (Landolt, *Ann. Ch. u. Pharm.*, **89.** 333.)

Sulphate of Arsen*di*MethylAmylium. $As\left\{\begin{matrix}(C_2H_3)_2\\(C_{10}H_{11})_2\end{matrix}\right. . O, SO_3$

Sulphate of Arsen*di*MethylEthylium. $As\left\{\begin{matrix}(C_2H_3)_2\\(C_4H_5)_2\end{matrix}\right. . O, SO_3$ Very deliquescent. Soluble in water. (Cahours & Riche.)

Sulphate of ArsenMethylium. $As\left\{(C_2H_3)_4 . O, SO_3\right.$ Deliquescent. Very soluble in water. (Cahours & Riche.)

Sulphate of Asparagin. Soluble in water, and alcohol. (Dessaignes, *Ann. Ch. et Phys.*, (3.) **34.** 152.)

Sulphate of Aspartic Acid. $C_8H_7NO_8, 2(HO, SO_3)$ Insoluble, or very sparingly soluble, in alcohol.

Sulphate of Atropin. $C_{34}H_{23}NO_6, HO, SO_3$ Readily soluble in water, and alcohol. Difficultly soluble in ether. (v. Planta.)

Sulphate of AzoNaphtylamin. $N_2\left\{\begin{matrix}C_{20}H_6''\\H_4\end{matrix}\right. . HO, HO, 2SO_3$ Permanent. Sparingly soluble, with partial decomposition, in water, and alcohol. Much less soluble in water than free naphtylamin.

Sulphate of AzoPhenylamin. Almost insoluble in water, alcohol, or ether. (Zinin.)

Sulphate of Baryta. BaO, SO_3 Permanent. Soluble in 43000 pts. of cold water. (Kirwan, *Min.*, **1.** 136 [T.].) Soluble in 200000 pts. of water. (Margueritte, *C. R.*, **38.** 308.) 100 pts. of cold water dissolve 0.002 pt. of it. (Ure's *Dict.*) Not absolutely insoluble in water. (Mulder, *Die Silberprobirmethode*, p. 12; Fresenius.) A solution of chloride of barium containing 1 pt. of Ba O in 71000 pts. of water, when treated with sulphuric acid becomes turbid after the lapse of half an hour. (Harting, *J. pr. Chem.*, **22.** 50.) A solution of nitrate of baryta containing one pt. of Ba O in 25000 pts. of water gives a distinct cloud when treated with sulphuric acid, or a solution of sulphate of soda; with 50000 @ 100000 pts. of water a slight turbidity is produced; with 200000 @ 400000 pts. of water the mixture becomes turbid after the lapse of some minutes; while with 800000 pts. of water the reaction ceases. (Lassaigne, *J. Chim. Méd.*, **8.** 526.)

Somewhat soluble in dilute acids, as chlorhydric and nitric acids. (Piria, *Il Cimento*, 1847, **5.** 257, cited by Siegle, who corroborates the observation, *J. pr. Ch.*, 1856, **69.** 142.)

Insoluble in hot or cold water. Cold dilute acids dissolve small quantities of it, and cold concentrated acids considerably more. Boiling chlorhydric acid takes up a considerable amount of it. Of all the acids, acetic acid dissolves the least, as has been shown by Siegle. (Fresenius, *Quant.*, p. 125.)

Precipitated sulphate of baryta, washed with water and dilute nitric acid until the last traces of chloride of barium had been removed, being treated with dilute acids, gave the following results: — 0.577 grm. of Ba O, S O_3 being boiled during about 5 minutes in 168 c.c. of chlorhydric acid of 1.03 sp. gr., the solution filtered after it had become cold, was found to contain 0.0075 grm. of sulphate of baryta; 0.679 grm. of Ba O, S O_3 being boiled for about a quarter of an hour with 230 c.c. of chlorhydric acid of 1.02 sp. gr., the solution, filtered while still warm, was found to contain 0.048 grm. of sulphate of baryta; — 0.4 grm. of Ba O, S O_3 being heated, during a quarter of an hour, with 150 c.c. of nitric acid of 1.02 sp. gr., the solution was found to contain 0.165 grm. of sulphate of baryta; — 0.4 grm. of Ba O, S O_3 being heated during a quarter of an hour with 80 c.c. of acetic acid of 1.02 sp. gr. the fluid was found to contain in solution 0.002 grm. of sulphate of baryta. Since the small portions of chloride of barium, which always contaminate precipitated sulphate of baryta, cannot be removed by washing with water alone, and hence necessitate the employment of some dilute acid, it is worthy of note that acetic acid is to be recommended for this purpose, rather than nitric or chlorhydric acid, for, as is indicated above, it dissolves less sulphate of baryta than either of the other acids. (Siegle, *J. pr. Ch.*, 1856, **69.** pp. 146, 147.)

500 pts. of nitric acid, of 1.167 sp. gr., can dissolve 1 pt. of sulphate of baryta; this is also soluble even in the weakest nitric or chlorhydric acid, thus: — While 0.062 gr. of sulphate of baryta can be held in solution by 1000 grs. of nitric acid of 1.032 sp. gr., the same quantity of the salt requires 50000 grs. of distilled water to dissolve it. This solubility of sulphate of baryta is influenced to a greater extent by the bulk than by the strength of the acid. (Calvert, *Phil. Mag.*, (4.) **11.** 390.) Sparingly soluble in nitric acid, both strong and dilute. (Price; Nicholson; Noad.) Somewhat soluble in chlorhydric acid when a large bulk of this acid is present; this solubility is much less marked, however, in presence of an excess of chloride of barium. (Noad.)

When treated with chlorhydric or nitric acid at the ordinary temperature it is not in the least attacked at first, and after the lapse of several days only a faint trace is dissolved, but if sulphate of baryta is boiled with chlorhydric or nitric acid a trace of it is dissolved at once; the addition of either a dilute solution of chloride of barium or of dilute sulphuric acid causing the formation of a precipitate. Mere dilution with water will not reprecipitate the dissolved sulphate of baryta. (H. Rose, *Pogg. Ann.*, **95.** pp. 104 - 109.)

Soluble in boiling concentrated sulphuric acid, crystallizing out as the solution cools; it is completely precipitated from this solution on the addition of water. (Withering; Hume, *Phil. Mag.*, **14.** 357 [T.]; Berzelius's *Lehrb.*)

The solubility of sulphate of baryta in water is also increased by the presence of several salts, especially by chloride of magnesium. (Fresenius, *Quant.*, p. 125.) Soluble to a notable extent in presence of salts of cerium. (Marignac, *Ann. Ch. et Phys.*, (3.) **27.** 217.) Soluble in considerable quantity in an aqueous solution of nitrate of ammonia; — in experiments upon this point it was found that the largest quantities of sulphate of baryta were dissolved when boiling solutions of sulphate of soda and chloride of barium, which had previously been mixed with nitrate of ammonia, were added by alternate drops to a boiling solution of nitrate of ammonia. A solution of 6.889 grms. of anhydrous sulphate of soda in 100 c.c. of water, of which 1 c.c. was capable of forming 0.1 grm. of sulphate of baryta, having been prepared, and another of chloride of barium, of which 1c.c. was equivalent to 0.37 grm. of sulphate of baryta, portions of these were added to a boiling solution of nitrate of ammonia as follows (the amount of the liquid last named being 230c.c. of cold saturated solution): — $\frac{1}{4}$ c.c. of the solution of chloride of barium, then 2 c.c. of the solution of sulphate of soda, then $\frac{1}{2}$ c.c. of the chloride of barium, and again 2 c.c. of sulphate of soda, but no precipitate ensued, although 0.28 grm. of sulphate of baryta was contained in the liquid, until on the further addition of $\frac{1}{2}$ c.c. of chloride of barium a slight cloudiness occurred. The experiment being repeated, with the omission of the last half c.c. of chloride of barium solution, the perfectly clear solution obtained exhibited the following reactions: — Treated with concentrated solutions of sulphate of soda, sulphate of ammonia, acetate of baryta, and chloride of barium, considerable precipitates were immediately produced, but concentrated solutions of the chlorides of calcium, ammonium, potassium, and strontium occasioned no precipitates, nor was any precipitate produced by the addition of much water to the original solution, an excess of a sulphate or of a baryta salt being alone capable of causing precipitation. The solubility, or rather non-precipitation of sulphate of baryta is much more considerable when the solution of nitrate of ammonia is acidulated with chlorhydric acid, even so much as 2 grms. of sulphate of baryta having been obtained dissolved in a boiling solution of 500 c.c. of a saturated solution of nitrate of ammonia mixed with 50 c.c. of chlorhydric acid; as the solution cooled a portion of the sulphate of baryta separated with the crystals of nitrate of ammonia, but a considerable quantity of it still remained dissolved. But in this case, according to Erdmann, the great solubility of the sulphate of baryta is due to the presence of free chlorine, and should not be attributed to the ammonia salt; for in a mixture of 100 c.c. of a solution of nitrate of ammonia and 100 c.c. of a concentrated solution of chloride of ammonium not so much as 0.08 grm. of sulphate of baryta could be obtained dissolved. (Mittentzwey, *J. pr. Ch.*, 1858, **75.** 214.) Sulphate of baryta cannot be precipitated from solutions which contain free chlorine. (Erdmann, *J. pr. Ch.*, **75.** 215.) Nor is it precipitated from solutions containing normal soluble citrates, except on boiling, but citric acid alone exerts no such solvent influence. (Spiller, *J. Ch. Soc.*, **10.** 110.) In presence of tartaric acid the precipitation is retarded to a small extent, and also slightly by racemic acid. (Spiller.) The presence of metaphosphate of soda also prevents the precipitation of sulphate of baryta: — If to a solution of metaphosphate of soda a large quantity of dilute chlorhydric acid be added, and then a solution of chloride of barium be stirred in drop by drop, a clear solution is obtained, in which no immediate precipitate is produced on the addition of very dilute sulphuric acid, the liquid beginning to become cloudy on standing only after the lapse of several hours, or even days; a precipitate soon occurs, however, on boiling the solution. For the success of the above experiment, it is necessary that the sulphuric acid shall be sufficiently dilute and not be added in too great excess. Neither ordinary (*c*) phosphoric acid, nor pyro (*b*) phosphoric acid prevent the precipitation of sulphate of baryta. (Scheerer, *J. pr. Ch.*, 1858, **75.** 114.) Following up Scheerer's observations, Rube has corroborated them in a number of quantitative experiments, which may be found in *J. pr. Ch.*, 1858, **75.** 115. Rube found that the precipitates finally produced were mixtures of phosphate and sulphate of baryta.

Chloride of ammonium has far less solvent power over sulphate of baryta than nitrate of ammonia: — 0.006 grm. of anhydrous sulphate of soda was dissolved in 137 c.c. of a concentrated solution of chloride of ammonium, 1 c.c. of a concentrated solution of chloride of barium was added, and the whole allowed to cool; a faint cloudiness was perceptible at the end of half an hour, and after 24 hours a crystalline precipitate had fallen, which weighed 0.0092 grm., instead of 0.0098 grm., which was required by theory. Hence it follows, that at most only 1 part of sulphate of baryta was dissolved in 230000 pts. of the solution of chloride of ammonium; but it must be observed, that the precipitate does not form immediately, and that the sulphate of baryta separates out completely only after a long time. In experiments with solutions of various strengths, which were not completely saturated, it was found that the precipitate occurred so much the sooner in proportion as the solution was more dilute, but in all the experiments the sulphate of baryta had separated completely at the end of 24 hours. (Mittentzwey, *J. pr. Ch.*, 1858, **75.** 216.) Unlike the sulphates of lime and lead, it is insoluble in a warm, concentrated solution of hyposulphite of soda. (Diehl, *J. pr. Ch.*, 1860, **79.** 431.) Soluble to a slight extent in an aqueous solution of acetate of "baryta" [? ammonia], at temperatures approaching the boiling point; the filtered solution, while yet hot, gives precipitates when treated with chloride of barium, with sulphuric acid, or carbonate of soda. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 181.) Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.) Unlike the sulphates of lime and strontia, which dissolve, it is completely insoluble in an aqueous solution of chloride of sodium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.) Insoluble in an aqueous solution of hyposulphite of soda. (Lœwe.) Decomposed when boiled with an aqueous solution of carbonate of potash, or carbonate of soda. (Dulong, *Ann. de Chim.*, **82.** 279.) Decomposed when boiled with an aqueous solution of carbonate of potash. (Marggraf, Kirchof, Klaproth, cited by H. Rose, *Pogg. Ann.*, **94.** 482.)

When sulphate of baryta is mixed with a dilute or concentrated solution of carbonate or bicarbonate of potash or of soda, and the mixture allowed to stand during a couple of days no decomposition occurs. After standing a longer time, a very slight decomposition ensues. If, however, the mixture of sulphate of baryta and carbonated alkali be boiled, some decomposition occurs at once, and by the repeated application of fresh portions of the solution of alkaline carbonate, the whole of the sulphate of baryta may be decomposed. In presence of a certain amount of sulphate of potash or sulphate of soda, however, this decomposition ceases: — thus, sulphate of baryta is not decomposed when boiled with a solution which contains equal weights of carbonate of potash and sulphate of potash (or of carbonate of soda and sulphate of soda). Nor is it completely decomposed when boiled in a solution containing 10 equivalents of carbonate of potash or carbonate of soda in 100 times as much water; only when 15 equivalents or more of the alkaline carbonate is present are the last traces of sulphate of baryta decomposed. (H. Rose, *Pogg. Ann.*, **94.** 484, *et seq.*)

No decomposition occurs when a mixture of sulphate of baryta, sulphate of potash, and carbonate of potash is boiled. (Dulong.) After boiling during four hours a mixture of $\frac{1}{5}$ of an equivalent of BaO, CO_2, $\frac{4}{5}$ of an equivalent of BaO, SO_3, $\frac{1}{5}$ of an equivalent of NaO, SO_3, and $\frac{4}{5}$ of an equivalent of NaO, CO_2, it did not appear that the relative proportions of the four salts had changed sensibly. But one equivalent of sulphate of baryta may be decomposed by boiling it at once with six equivalents of carbonate of soda. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** pp. 337, 338.) When one equivalent of Ba O, S O$_3$ is boiled with one equivalent of K O, C O$_2$, in aqueous solution, $\frac{22{\cdot}17}{100}$ of it may be decomposed; when boiled with an equivalent of Na O, C O$_2$ $\frac{18{\cdot}73}{100}$ of it may be decomposed. On the other hand, when an equivalent of Ba O, C O$_2$ is boiled with one of K O, S O$_3$ $\frac{60}{100}$ of it may be decomposed, and when boiled with an equivalent of Na O, S O$_3$ $\frac{71{\cdot}82}{100}$ of it may be decomposed. These reactions may be disturbed by several influences, notably by the new insoluble salt which is formed tending to cover the original substance, and to protect it from further action, also by the cohesion of the original insoluble salt being increased by ebullition. Thus an equivalent of artificial Ba O, S O$_3$ having been boiled during two hours in water which contained an equivalent of Na O, C O$_2$, $\frac{17{\cdot}47}{100}$ of it were decomposed. In a second experiment similar to this, excepting that the Ba O, S O$_3$ employed had been used in a previous experiment, which lasted four hours, and was consequently covered with carbonate of baryta, only $\frac{15{\cdot}94}{100}$ of the Ba O, S O$_3$ were decomposed; while in a third experiment upon sulphate of baryta, like the last, from which the covering of carbonate had been removed by means of dilute nitric acid, $\frac{16{\cdot}84}{100}$ of the Ba O, S O$_3$ were decomposed. These disturbing influences were rendered still more evident by the following set of experiments, in which all the conditions were identical, excepting the time of boiling, which varied from thirty minutes, in the shortest, to sixteen hours, in the longest.

No. of hours during which the mixture of Ba O, S O$_3$ and Na O, C O$_2$ was boiled.	Percent of Ba O, S O$_3$ decomposed.
0h. 30m.	12.94
1 0	16.78
2 0	17.47
4 0	18.73
6 0	15.79
8 0	16.26
10 0	17.88
12 0	19.00
14 0	18.42
16 0	16.84

(Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** pp. 339–344, 348, 358. Compare Carbonate of Baryta.)

When powdered Ba O, S O$_3$ is digested for some time with a solution of carbonate of potash, there is a double decomposition; combinations of sulphuric acid and potash, and carbonic acid and baryta, being formed. (H. Davy, *Elements Chemical Philosophy*, p. 103.) Powdered sulphate of baryta being boiled with a solution of two or three times its weight of carbonate of potash decomposition occurs, the carbonic acid passing to the baryta and the sulphuric to the potash. (Henry, *Elements of Experimental Chemistry*, **2.** 331.) 300 grains of powdered Ba O, S O$_3$ having been boiled with 600 grains of carbonate of potash and water, evaporated to dryness, again diffused in water and a second time evaporated, being subsequently diluted [washed ?] with water and the precipitate treated with chlorhydric acid, this dissolved with effervescence, leaving a residue of 18 grains. (Klaproth's *Analytical Essays*, **2.** 228.) To 100 pts. [qu. grains ?] of precipitated (washed and dried) Ba O, S O$_3$, 59 pts. of dry K O, C O$_2$ were added, and the whole boiled during two hours in about four ounces of water, the solution was not evaporated to dryness, water being occasionally added to supply what was lost by evaporation. The precipitate was then washed with water, the Ba O, C O$_2$ dissolved by dilute nitric acid, and the insoluble residue washed and dried. Its weight was equal to 77 pts.; consequently 23 of the sulphate of baryta were decomposed by the carbonate of potash and converted into 19.5 of carbonate of baryta. On the other hand, quantities equivalent to those used above, of carbonate of baryta and sulphate of potash, viz., 85 pts. of Ba O, C O$_2$ and 74 pts. of K O, S O$_3$, were boiled in water as in the preceding experiment, the solution containing carbonate of potash was poured off, the precipitate washed with water, and the undecomposed carbonate of baryta dissolved in dilute nitric acid. The sulphate of baryta weighed 67 pts.; consequently 57 pts. of carbonate of baryta were decomposed by the sulphate of potash. In the first experiment 23 pts. of Ba O, S O$_3$ were decomposed, hence the 100 pts. of Ba O, S O$_3$ and 59 pts. of K O, C O$_2$ employed. became nearly as follows: 77 Ba O, S O$_3$, — 45.5 K O, C O$_2$, — 17 K O, S O$_3$, — 19.5 Ba O, C O$_2$. In the second experiment 57 of Ba O, C O$_2$ were converted into sulphate, hence the 85 pts. of Ba O, C O$_2$ and 74 of K O, S O$_3$ gave about 67 Ba O, S O$_3$, — 39.5 K O, C O$_2$, — 24.5 K O, S O$_3$, — 28 Ba O, C O$_2$. The decompositions, in both these cases, are very considerable; but as the quantities of the salts which result from the action of the same proportions of similar acids and bases are not equal, it is probable that the decomposition was not in either case complete, on account of the mixtures not having been sufficiently digested and evaporated to dryness. Supposing the insolubility of the sulphate of baryta in the first experiment to have prevented the complete action of the carbonate of potash, we must also suppose the same cause to have prevented that of the sulphate of potash on the carbonate of baryta in the second experiment; and allowing this cause to have operated equally in both cases, the mean of the quantities stated will probably express the result which would have been obtained by carrying each experiment to its utmost limit. On referring back to the quantities of salts used in each experiment, it will be seen [by Wollaston's scale] that they consisted of acids and bases in nearly the following proportions: — 34 pts. S O$_3$, 19 pts. C O$_2$, 66 pts. Ba O, 40 pts. K O; and these combined so as to give the mean of the two experiments, will stand thus: —

$$\begin{aligned}
24.5\ &S\,O_3 + 47.5\ Ba\,O &&= 72\ Ba\,O, S\,O_3\\
13.75\ &C\,O_2 + 28.75\ K\,O &&= 42.5\ K\,O, C\,O_2,\\
9.5\ &S\,O_3 + 11.25\ K\,O &&= 20.75\ K\,O, S\,O_3,\\
5.25\ &C\,O_2 + 18.50\ Ba\,O &&= 23.75\ Ba\,O, C\,O_2.
\end{aligned}$$

That these numbers express the quantities which would result from the perfect action of the salts upon each other will appear probable by examining the results of Klaproth's experiment. He found that 600 pts. of K O, C O$_2$ decomposed 282 pts. of K O, S O$_3$, consequently 59, the quantity employed in the experiment described above, should decompose 27.6, which is within 4 of the stated average. We may then safely infer that not more than 72 out of 100 pts. of Ba O, S O$_3$ can be decomposed by carbonate of potash, whilst the latter salt is exposed to the counteraction of the sulphate of potash formed by the decomposition of the 72 pts., and it would appear that the power of the latter is sufficient to prevent the action of almost any quantity of carbonate of potash however large, upon the smallest quantity of sulphate of baryta. In Klaproth's experiment not more than 165 pts. of carbonate of potash could have been decomposed by 282 pts. of sulphate of baryta and the sulphate of potash formed, amounting to 209 pts., by its power of reproducing sulphate of baryta, appears to have prevented the remaining 435 of carbonate of potash from decomposing 18 of sulphate of baryta, although it contained at least 30 times more carbonic acid than the baryta could have combined with. To try how far these inferences would be strengthened by experiment, 72 pts. of $Ba\,O,\,S\,O_3$, 42.5 of $K\,O,\,C\,O_2$, 20.75 of $K\,O,\,S\,O_3$, and 23.75 of $Ba\,O,\,C\,O_2$ were boiled together in water for about two hours. The result did not prove that the quantities are precisely those which prevent the reciprocal action, but they showed that the error is not very considerable; an increase of about 3.75 of $Ba\,O,\,S\,O_3$ having been found. The result of this experiment is sufficient to show that the decomposition of sulphate of baryta by carbonate of potash is prevented from taking place by the power which sulphate of potash and carbonate of baryta possess of reproducing it, and *vice versa*, that the power of sulphate of potash and carbonate of baryta of effecting mutual decomposition is equally destroyed from the corresponding power of reproduction belonging to sulphate of baryta and carbonate of potash. (Richard Phillips, *Journ. of Royal Inst. of Gt. Br.*, 1816, **1.** 80. [Here given somewhat literally, in view of the neglect which the article has hitherto received.].)

Sulphate of baryta is not decomposed like sulphate of lime when digested with an aqueous solution of carbonate of ammonia. (Weppen, *Arch. d. Pharm.* (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 183.) Unacted upon by a boiling aqueous solution of caustic potash, if carbonic acid be excluded. It is not decomposed by an aqueous solution of carbonate of ammonia at the ordinary temperature, or, at least, no more than by solutions of the fixed alkaline carbonates; even on boiling the decomposition is but slight. (H. Rose, *Pogg. Ann.*, **95.** pp. 104 – 109.)

On being exposed to a temperature of about 250° in a closed tube, during 60 hours, with an aqueous solution of bicarbonate of soda, a notable quantity of sulphate of baryta was dissolved, and subsequently crystallized on the sides of the tube; larger crystals were obtained when chlorhydric acid was used instead of the bicarbonate of soda. No sensible solution of the sulphate of baryta was observed when pure water or solutions of alkaline sulphides were used instead of the chlorhydric acid, or bicarbonate of soda. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 155.)

*Bi*Sulphate of Baryta. Both of these compounds absorb water from the air, with decomposition.
$a = Ba\,O,\,H\,O,\,2\,S\,O_3$
$b = Ba\,O,\,H\,O,\,2\,S\,O_3 + 2\,Aq$
They are instantly decomposed by water, but are soluble in concentrated sulphuric acid, the more readily in proportion as this is warmer. (Berzelius, in his *Lehrb.*, **3.** 359.)

Sulphate of Baryta & of Lime. Occurs as the mineral *Dreelite*. Decomposed by chlorhydric acid, with partial solution. (Dufrénoy.)
$3\,(Ba\,O,\,S\,O_3)\,;\;Ca\,O,\,S\,O_3$

Sulphate of Baryta & *of binoxide* of Platinum.

I.) *basic.* Insoluble in water. Readily soluble in boiling concentrated chlorhydric acid; and is slightly decomposed by aqua-regia. Not attacked by boiling nitric, sulphuric, phosphoric, or acetic acid; or by ammonia-water. (E. Davy.)

Sulphate of Baryta & of Soda.

Sulphate of Baryta & of Toluenyl. (*SulphAnisolate of Baryta.*) Soluble in water. (Cahours.)
$C_{14}\,H_7\,O,\,Ba\,O,\,2\,S\,O_3 + Aq$

Sulphate of Bebeerin. Readily soluble in acidulated water. (Parrish's *Pharm.*, p. 413.)

Sulphate of Benzamic Acid. Permanent. Soluble in boiling, less soluble in cold water, and alcohol. Gradually decomposed by hot water. (Gerland.)
$N\,C_{14}\,H_7\,O_4,\,H\,O,\,S\,O_3 + 2\,Aq$

Sulphate of Benzidin. Almost insoluble in boiling water, or in alcohol.
$N_2 \left\{ \begin{matrix} C_{12}\,H_4'' \\ C_{12}\,H_5 \\ H_3 \end{matrix} \right. .\,H\,O,\,H\,O,\,2\,S\,O_3$

Sulphate of Benzol.
$C_{14}\,H_6\,O_2'',\,2\,S\,O_3$

Sulphate of Berberin. Sparingly soluble in cold water.
$N \left\}\, C_{42}\,H_{19}\,O_{10}''' \right. .\,H\,O,\,H\,O,\,2\,S\,O_3$

Sulphate of Bismuth.

I.) *mono.* Insoluble in water. Soluble in concentrated sulphuric acid. (Heintz; Dumas.) Soluble in nitric and chlorhydric acids.
$Bi\,O_3,\,S\,O_3$

II.) *bi.* Decomposed by water. (Heintz.) Soluble in nitric, chlorhydric, and warm dilute sulphuric acid.
$Bi\,O_3,\,2\,S\,O_3 + 3\,Aq$

III.) *ter.* Decomposed by water. Soluble in dilute sulphuric acid.
$Bi\,O_3,\,3\,S\,O_3$

IV.) *peracid.* Deliquescent.

V.) *tri.* Insoluble in water. (Dumas, *Tr.*)
$3\,Bi\,O_3,\,S\,O_3$

According to Laurent, there are two sulphates of bismuth, the one soluble, the other insoluble, in water. When bismuth is dissolved in boiling nitric acid, and the solution treated with sulphuric acid, there is sometimes no precipitate whatever produced, and at other times a very abundant one. If a few drops of water are poured upon this precipitate it sometimes dissolves suddenly, and at other times remains perfectly insoluble, however large an amount of water be added. These phenomena are explained by the facts, that if sulphuric acid is added to the cold solution of the nitrate, care being taken to operate upon a sufficiently small quantity, so that the mixture may not become heated, there will be no precipitate produced; if too much sulphuric acid be added, there will be deposited a sulphate of bismuth, crystallized in needles, which is scarcely soluble in sulphuric acid, but extremely soluble in water; if upon this crystalline sulphate water be poured it will dissolve immediately, but if the solution be heated, whether the quantity of water present be large or small, a sulphate of bismuth will gradually be precipitated, which is insoluble either in hot or cold water, and which will not dissolve even on the addition of a considerable quantity of sulphuric acid. (Laurent, in his *Chemical Method* (Cavendish Soc. Ed.), p. 163.)

Sulphate of Bismuth & of Potash. Ppt. Decomposed by water. Insoluble in a saturated aqueous solution of sulphate of potash. (Heintz.)
$Bi\,O_3,\,3\,S\,O_3\,;\;3\,(K\,O,\,S\,O_3)$

Sulphate of Bismuth Ethyl.

Sulphate of *bi*BromAllylamin. Soluble in water.

Sulphate of Brucin.

I.) *normal.* Readily soluble in water. Sparingly soluble in alcohol. $N_2\left\{C_{46}H_{26}O_8^{VI}\right. . HO, SO_3 + 7 Aq$

II.) *acid.* May be washed with ether.

Sulphate of Butyl. *Vid.* ButylSulphuric Acid.

Sulphate of Cacodyl. Very deliquescent.

Sulphate of Cacoplatyl. Permanent.
$As\left\{\begin{matrix}C_2H_3\\C_2H_2Pt\end{matrix}\right. .O, SO_3 + 2 Aq$

Sulphate of Cacothelin. Decomposed by water. Insoluble in alcohol. Soluble in sulphuric acid. (Strecker.)

Sulphate of Cadmium.

I.) Efflorescent. Easily soluble in water. $CdO, SO_3 + 4 Aq$ (Stromeyer.) Soluble in 1.04 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.)

II.) Sparingly soluble in water. (Stromeyer.) $2 CdO, SO_3 + Aq$

Sulphate of Cadmium & of Magnesia. $CdO, SO_3; MgO, SO_3 + 6 Aq$ Easily soluble in water. (Schiff.)

Sulphate of Cadmium & of Potash. Easily efflorescent. $CdO, SO_3; KO, SO_3 + 6 Aq$

Sulphate of Cadmium & of Soda. $CdO, SO_3; NaO, SO_3 + 2 Aq$

Sulphate of Cadmium*bi*amin. (*Ammonio-Sulphate of Cadmium.*) Soluble in water, with partial decomposition. (H. Rose.) $N_2\left\{H_6\right. . CdO, SO_3$

Sulphate of Caffein. There is an acid salt, and also a neutral salt; they dissolve more readily in water than in alcohol. (Guenther.) Easily decomposed by water. (Gerhardt, *Tr.*) Caffein is easily soluble in dilute sulphuric acid, but no solid salt can be obtained. (Mulder.) Sparingly soluble in ether. (Herzog.)

Sulphate of *tri*Caproylamin.

Sulphate of Capryl. *Vid.* OctylSulphuric Acid.

Sulphate of Caprylamin. *Vid.* Sulphate of Octylamin.

Sulphate of Carburetted Hydrogen. *Vid.* EthylSulphate of Wine Oil.

"**Sulphate of Carbyl.**" *Vid.* Ethionic Acid(Anhydrous).

Sulphate *of protoxide* of Cerium.

a = anhydrous. Difficultly soluble in water. CeO, SO_3

b = hydrated. Very soluble in cold water, but on boiling the solution $CeO, SO_3 + 1\frac{1}{2} Aq$ is precipitated. $CeO, SO_3 + 3 Aq$ (Otto.) Much more soluble in *cold* than in hot water. (Marignac, *Ann. Ch. et Phys.*, (3.) **27.** 213.) Sulphate of cerium may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

Sulphate *of sesquioxide* of Cerium. Efflorescent. Soluble in a small quantity of water. $Ce_2O_3, 3 SO_3$ When the aqueous solution is diluted with much water and boiled, a basic salt is precipitated. (Berzelius's *Lehrb.*) Soluble in dilute sulphuric acid. The basic sesquisulphate of ceric oxide (Bunsen's) requires a very large excess of sulphuric acid for its solution. (Ordway.)

Sulphate *of prot- & of sesquioxide* of Cerium. (*Cereso Ceric Sulphate.*)

I.) *normal.* Completely soluble in a small quantity of water, but on adding a larger quantity of water a basic salt is precipitated, while sulphate of the protoxide is dissolved. When treated with warm chlorhydric acid it is readily transformed into protochloride, chlorine being evolved. (H. Rose, *Tr.*) Easily soluble in water acidulated with nitric or sulphuric acid. When this solution is diluted with a large excess of water a basic salt (No. 2) is precipitated. (Marignac, *Ann. Ch. et Phys.*, (3.) **27.** 212.)

II.) *basic.* Almost entirely insoluble in pure water. Very sparingly soluble in cold dilute nitric or sulphuric acid. (*Ceroso Ceric sub Sulphate.*) $3 CeO, 2 Ce_2O_3, 4 SO_3 + 7 Aq$ Easily soluble, with decomposition, in boiling acids. (Marignac, *loc. cit.*, pp. 212, 221.) Soluble in 2500 pts. of water. (Mosander.) Soluble in chlorhydric acid, from which it is reprecipitated on the addition of alkalies.

Sulphate *of protoxide* of Cerium & of Potash. $KO, SO_3; CeO, SO_3$ Only slightly soluble in cold, but rather freely soluble in boiling water. Completely insoluble in a saturated aqueous solution of sulphate of potash. (Berzelius.) Less soluble than the sulphate of potash and of yttria. (Gahn & Berzelius.) This precipitate forms even in solutions which contain a small quantity of free acid, and is not soluble in dilute acids. (H. Rose, *Tr.*) Slightly soluble in dilute sulphuric acid. (Hisinger & Berzelius.)

Sulphate *of sesquioxide* of Cerium & of Potash. $KO, SO_3; Ce_2O_3, 3 SO_3$ Difficultly soluble in water. Completely insoluble in a saturated aqueous solution of sulphate of potash. (Berzelius & Hisinger.)

Sulphate *of protoxide* of Cerium & of Soda. $2 (CeO, SO_3); NaO, SO_3$ Much more soluble in water than the corresponding potash salt. (Beringer.)

Sulphate of Ceryl. Entirely soluble in water, especially if this be mixed with a little alcohol. $C_{54}H_{55}O, HO, SO_3$ Soluble in ether.

Sulphate of CetylAnilin. Is the most soluble of the salts of cetylanilin. It is soluble in alcohol, from which it is completely precipitated on the addition of water.

Sulphate of Chelidonin. Permanent. Very readily soluble in water, spirit, and absolute alcohol. Insoluble in ether. (Probst, *Ann. der Pharm.*, **29.** 127.)

Sulphate of ChlorAnilin. Soluble in boiling, less soluble in cold water. Less soluble in alcohol than in water. $N\left\{\begin{matrix}C_{12}H_4Cl\\H_2\end{matrix}\right. . HO, SO_3$ (Hofmann.)

Sulphate of *di*Chloride of Mercury.

Sulphate of *penta*Chloride of Phosphorus.

I.) PCl_5, SO_3 \
II). $PCl_5, 2 SO_3$ } Decomposed by water.

Sulphate of Chloride of Selenium. Deliquescent. Readily soluble, with decomposition, in water. $2 (Se_2Cl_3), 5 SO_3$ (?)

Sulphate of *bi*Chloride of Sulphur. Decomposed by water, and alcohol. (Millon.) SCl_2, SO_3

*Bi*Sulphate of *ter*Chloride of Sulphur.
(*ChloroSulphuric Acid. SulphobiaciChloride.*)
$SClO_2$ or $SCl_3 + 2SO_3$
Decomposed by water, with great evolution of heat. (Regnault.) Also decomposed by alcohol, and more difficultly by ether.

*Quinqui*Sulphate of *ter*Chloride of Sulphur.
$SCl_3, 5SO_3$
Slowly decomposed by water. When first put into water it sinks to the bottom, and does not dissolve for several hours, even when stirred. It appears to be converted into a hydrate before it dissolves. Also decomposed by alcohol, and ether.

Sulphate of *bi*Chloride of Tin. Slowly soluble in water, with decomposition.

Sulphate of ChloroBenzene. *Vid.* ChloroPhenylSulphurous Acid.

Sulphate of ChloroBenzylene. *Vid.* Chloride of SulphoBenzoyl.

Sulphate of *bi*ChloroBenzylene. *Vid.* ChloroSulphoBenzoic Acid.

Sulphate of ChloroCodein.
$N\left\{\begin{matrix} C_{36}H_{19}ClO_6{}'' \\ H \end{matrix}\right. . HO, SO_3 + 4Aq$
Very readily soluble in boiling, less soluble in cold water, and alcohol. (Anderson.)

Sulphate of ChloroNitroHarmalin.

I.) *normal.* Soluble in hot, less soluble in cold alcohol.

II.) *acid.* Soluble in hot, less soluble in cold alcohol.

Sulphate of ChloroStrychnine.
$N_2\left\{ C_{42}H_{21}ClO_4{}^{vi} . HO, SO_3 + 7Aq \right.$
Soluble in water. (Laurent, *Ann. Ch. et Phys.*, (3.) **24.** 313.)

Sulphate *of protoxide* of Chromium.
$CrO, SO_3 + Aq$
Deliquescent.

Sulphate *of sesquioxide* of Chromium.

I.) *normal* or *ter.*

α = *Blue soluble modification.*
$Cr_2O_3, 3SO_3 + 15Aq$
Soluble in 0.833 pt. of cold water. Melts in its water of crystallization at 100°, but is transformed at the same time into the green modification (γ). When the aqueous solution is heated to 65° @ 70°, the green modification is produced. Less soluble in spirit than in water. When an aqueous solution of the blue salt is covered with alcohol in such a manner that the two liquids do not mix, the blue solution commences to become green at the top, and the reaction goes on from above downward, until the whole solution has become green. (Schrœtter, in *Berzelius's Lehrb.*)

β = *Insoluble modification.*
$Cr_2O_3, 3SO_3$
Insoluble in water, in ammonia-water, or in sulphuric, chlorhydric, or nitric acids, or in aqua-regia. Not decomposed by cold aqueous solutions of the caustic or carbonated alkalies, and only very incompletely by boiling caustic alkalies.

γ = *Green soluble modification.*
$Cr_2O_3, 3SO_3 + 5Aq$
Readily soluble in water. Soluble in alcohol, and in concentrated sulphuric acid. When a concentrated aqueous solution is allowed to stand, it passes into the blue modification in the course of 3 or 4 weeks. (Schrœtter, in *Berzelius's Lehrb.*)

II.) *bi* (*green*).
$Cr_2O_3, 2SO_3$
Soluble in a small quantity of water, but a precipitate of No. 3 is produced in this solution when it is diluted, and so much the more readily in proportion as more water is added. On evaporation, however, this precipitate redissolves. If the dilute solution is filtered off from the precipitate and then heated, it deposits a fresh portion of the basic salt No. 3, but this redissolves when the solution is boiled. A still more abundant precipitate is produced when the dilute solution is heated. Concentrated solutions of 1.219 or more sp. gr. can be boiled without becoming cloudy, but a solution of 1.116 sp. gr. begins to become turbid when heated to 57°; of 1.037 @ 1.031 at 64°; of 1.002 at 45°; and of 1.001 at 55°; a still more dilute solution remains clear even at a boiling heat. (Schrœtter.)

III.) Insoluble in water.
$3Cr_2O_3, 2SO_3 + 14Aq$
(*Green.*)
Soluble in acids, readily when moist, and more difficultly in proportion as it has been more strongly dried or heated. Slowly, but completely, decomposed by boiling aqueous solutions of the caustic or carbonated alkalies.

IV.) Insoluble in water. Soluble in acids.
$2Cr_2O_3, 3SO_3$
(*Rose-red.*)
(Krueger.)

Sulphate *of protoxide* of Chromium & of Potash.
$CrO, SO_3; KO, SO_3 + 6Aq$
Soluble in water; less soluble in alcohol. (Peligot, *Ann. Ch. et Phys.*, (3.) **12.** 546.)

Sulphate *of sesquioxide* of Chromium & of Potash.

I.) *anhydrous.* Insoluble in water.
$KO, SO_3; Cr_2O_3, 3SO_3$

Modif. α (*not decomposed by water*). Unacted upon by ammonia-water, or by sulphuric, chlorhydric, or nitric acid, even when boiled with them. Decomposed by long boiling with a solution of caustic potash. (Hertwig; Hilgard, *Am. J. Sci.*, (2.) **24.** 390.)

Modif. β (*Decomposed by boiling water*). Unacted upon by cold, decomposed by long-continued boiling with water. (Hertwig; Hilgard, *loc. cit.*)

II.) *bihydrated* (*green*).
$Cr_2O_3, 3SO_3; KO, SO_3 + 2Aq$
Dissolves after long-continued boiling with water, more rapidly if acid be present; but neither water nor dilute chlorhydric or sulphuric acid have any action upon it at the ordinary temperature; at least none in the course of several days. (Hertwig.)

III.) *bihydrated, with* 24 *equivalents of water.*
(*Potash Chrome Alum.*)
$Cr_2O_3, 3SO_3; KO, SO_3 + 24Aq$
Permanent. Effloresces in warm air. Soluble in 5 @ 6 pts. of cold water. When the solution is heated to 50° @ 70° partial decomposition occurs, a quantity of the green modification of sulphate of chromium being formed.

If chrome alum be dissolved in 2 or 3 pts. of hot water, and this solution boiled during 20 or 30 minutes, or even only heated to 60° @ 70°, the 24 Aq salt is converted to a green compound containing only 6 @ 7 equivalents of water of crystallization, which is more soluble in water than the original alum; hence the boiled solution does not deposit crystals on cooling. After the lapse of several days a portion of the original salt, with 24 equivalents of Aq, is reproduced and deposited, but this change is extremely slow: after two months only 50 or 60% of the salt originally dissolved was deposited; and if boiled solutions be kept out of contact with the air, they may be preserved for an indefinite length of time without crystallizing. This change of the salt containing 24 Aq to others less hydrated may also be effected by heating it to 100°, at which temperature the crystals melt in their water of crystallization; *aqueous fusion* is in every case necessary to produce this change. When all the water of crystallization has been expelled from chrome alum by heating it at temperatures from 300° @ 350°, it still dissolves when boiled for a few minutes in water, but if it is heated beyond 350° a change ensues, and the compound becomes entirely insoluble in boiling water. (Lœwel, *Ann. Ch. et Phys.*, (3.) **44.** 313.) Insoluble in alcohol, by which it may be precipitated from the aqueous solution. (Berzelius's *Lehrb.*)

III.) Completely insoluble in water or in dilute acids. (Wittstein.)
$2(Cr_2O_3, 2SO_3); KO, SO_2$

Sulphate *of sesquioxide* of Chromium & of Soda.

a = *violet modif.* Efflorescent. Soluble in water.
(*Soda Chrome Alum.*)
$Cr_2O_3, 3SO_3; NaO, SO_3 + 24Aq$

b = *green modif.*
$Cr_2O_3, 3SO_3; NaO, SO_3 + 8Aq$

I.) Sulphate of Cinchonidin(of Wittstein).

a = *normal.*
$N_2\{C_{36}H_{20}O_2^{VI}, HO, SO_3 + 3Aq$

Soluble in 95 pts. of water at 10°.
" 1 pt. " boiling.
" 48 pts. of alcohol at 10°.
" 0.5 pt. " boiling.
" 18 pts. of ether at 10°.

b = *acid.* Easily soluble in water.

II.) Sulphate of Cinchonidin(of Pasteur).

a = *normal.* Soluble in 130 pts. of water at 17°, and in 16 pts. of water at 100°. Very easily soluble in alcohol. Almost insoluble in ether. (Leers, *Ann. Ch. u. Pharm.*, **82.** 153.) Soluble in 30 @ 32 pts. of cold absolute alcohol, and in 7 pts. of cold alcohol of 90%. (Bussy & Guibourt, *Journ. de Pharm. et Chim.*, 1852, (3.) **22.** 414.)
$N_2\{C_{40}H_{24}O_2^{VI}.HO, SO_3$

As regards solubility in water, spirit, and ether, it is not to be distinguished from sulphate of quinine. (Winckler, from *Buchn. Rep.*, (2.) **49.** 1, in *Pharm., Central B.*, 1848, **19.** 310.)

b = *acid.* Easily soluble in water. (Leers, *loc. cit.*, p. 154.)

Sulphate of *a*Cinchonin. Permanent.

I.) *normal.* Soluble in about 54 pts. of water at the ordinary temperature. Soluble in 11.5 pts. of absolute alcohol at 13°, and in 6.5 pts. of alcohol of 0.85 sp. gr., at 13°. Insoluble in ether. (Baup, *Ann. Ch. et Phys.*, 1824, (2.) **27.** 326.) 1 pt. of "sulphate of cinchonin" is soluble in 53.33 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht, für* 1854, p. 75.) 100 pts. of chloroform dissolve 3 pts. of it. (Schlimpert, *Kopp & Will's J. B., für* 1859, p. 405.) "Sulphate of huanokin" is scarcely at all soluble in water. Easily soluble in an excess of sulphuric acid. Difficultly soluble in alcohol, and ether. (A. Erdmann.)
("*Basic.*")
$N_2\{C_{40}H_{24}O_2^{VI}.HO, SO_3 + 2Aq$

II.) *acid.* Permanent, or slightly efflorescent if the air be dry. Soluble in 0.46 pt. of water at 14°, the saturated solution containing 68.49% of it; very soluble in boiling water. Soluble in 0.9 pt. of alcohol, of 0.85 sp. gr., at 14°, and in 1 pt. of absolute alcohol, at 14°. Insoluble in ether. (Baup, *loc. cit.*, p. 325.)
("*Neutral.*")
$N_2\{C_{40}H_{24}O_2^{VI}.HO, HO, 2SO_3 + 6Aq$

Sulphate of *β*Cinchonin. Soluble in 75 pts. of cold, and in 14 pts. of hot water; in 13.6 pts. of cold, and in 1.5 pt. of hot alcohol, of 80%. Insoluble in ether. (W. Schwabe, *Kopp & Will's J. B., für* 1860, p. 364.)
$N_2\{C_{40}H_{24}O_2^{VI}.HO, SO_3 + 2Aq$

Sulphate of Cobalt.

I.) *mono.*

a = *anhydrous.* Somewhat difficultly soluble in cold, more readily soluble in hot water. (Fresenius, *Quant.*, p. 138.)
CoO, SO_3

100 pts. of water at °C.	Dissolve of the salt, calculated as anhydrous, pts.
3°	26.2
10°	30.5
20°	36.4
24°	38.9
29°	40.0
35°	46.3
44°	50.4
50°	55.2
60°	60.4
70°	65.7

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

b = *hydrated.* Efflorescent. 100 pts. of water at 15.5° dissolve 6 pts. of the crystallized salt. (Ure's *Dict.*) Soluble in 24 pts. of water at 10°. Insoluble in alcohol.
$CoO, SO_3 + 7Aq$

Calculated as anhydrous salt, from Persoz's observation it is soluble in 44.33 pts. of water. (Kremers.) Sulphate of cobalt is completely precipitated from its aqueous solution on the addition of glacial acetic acid. (Persoz, *Chim. Moléc.*, p. 346; also *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

II.) *basic.* Insoluble in water. (Berzelius.)

Sulphate of Cobalt & of Copper. Easily soluble in water. (Liebig.)
$2(CoO, SO_3); CuO, SO_3 + 36Aq$

Sulphate of Cobalt, of Copper, of Magnesia, of Potash, & of Zinc.
$CoO, SO_3; CuO, SO_3; MgO, SO_3; 4(KO, SO_3); ZnO, SO_3 + 24Aq$

Sulphate of Cobalt, of Copper, & of Potash. Soluble in water. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 59.)
$CoO, SO_3; CuO, SO_3; 2(KO, SO_3) + 12Aq$

Sulphate of Cobalt, of Iron, & of Potash.
$CoO, SO_3; FeO, SO_3; 2(KO, SO_3) + 12Aq$

Sulphate of Cobalt & of Magnesia. Easily soluble in water. (Winkelblech.)
$3CoO, SO_3; MgO, SO_3 + 28Aq$

Sulphate of Cobalt, of Magnesia, & of Potash.
$CoO, SO_3; MgO, SO_3; 2(KO, SO_3) + 12Aq$

Sulphate of Cobalt, of Manganese, & of Potash.
$CoO, SO_3; MnO, SO_3; 2(KO, SO_3) + 12Aq$

Sulphate of Cobalt, of Nickel, & of Potash.
$CoO, SO_3; NiO, SO_3; 2(KO, SO_2) + 12Aq$

SULPHATE OF COBALT & OF POTASH. $CoO, SO_3; KO, SO_3 + 6 Aq$ Somewhat less soluble in water than sulphate of cobalt. (Proust; Guignet, *C. R.*, **49.** 454.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	19.1
12°	30.0
15°	32.5
20°	39.4
25°	45.3
30°	51.9
35°	55.4
40°	64.6
49°	81.3

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

Considerably more soluble in water than the corresponding nickel salt. The aqueous solution saturated (slightly supersaturated) at

20°	contains	13.968%	of the anhydr. salt.
40°	"	19.539	" "
60°	"	24.372	" "
80°	"	31.816	" "

(C. v. Hauer, *J. pr. Ch.*, 1858, **74.** 434.)

SULPHATE OF COBALT, OF POTASH, & OF ZINC. $CoO, SO_3; 2(KO, SO_3); ZnO, SO_3 + 12 Aq$

SULPHATE OF COBALT & OF ZINC. Efflorescent. Very soluble in water. (Ure's *Dict.*)

SULPHATE OF COBALT*ter*AMIN. (*Ammonio Sulphate of Cobalt.*) $N_3\{H_9 . CoO, SO_3$ Partially soluble, with decomposition, in water, while basic sulphate of cobalt remains undissolved. (H. Rose.) Appears to be very soluble in ammonia-water; but this solution deposits an insoluble subsalt when diluted with much water. Alcohol produces a precipitate in this solution, but the salt is thereby decomposed. (Fremy, *Ann. Ch. et Phys.*, (3.) **35.** 269.)

SULPHATE OF CODEIN. $N\left\{\begin{matrix}C_{36}H_{20}O_6\\H\end{matrix}\right. . HO, SO_3+5 Aq$ Soluble in 30 pts. of cold water. Very soluble in warm water.

SULPHATE OF CONIIN. Deliquescent. Soluble in water in all proportions. Also soluble in a mixture of alcohol and ether. (Geiger.) Very easily soluble in water. (Blyth, *J. Ch. Soc.*, **1.** 354.) Soluble in all proportions in alcohol. (Charland & Henry.)

SULPHATE *of dinoxide* OF COPPER? Cu_2O, SO_3 Insoluble in water or in concentrated sulphuric acid. Soluble, with decomposition, in nitric acid. (Berzelius, *Lehrb.*, **3.** 800.)

SULPHATE *of protoxide* OF COPPER.

I.) *mono.*

a = *anhydrous.* CuO, SO_3 Combines with water with great evolution of heat. (Graham.) 100 pts. of water at 0° dissolve 15.107 pts. of it. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 226.)

b = $CuO, SO_3 + Aq$ (*Green Sulphate of Copper.*) Permanent. Soluble in water.

c = $CuO, SO_3 + 2 Aq$

d = $CuO, SO_3 + 5 Aq$ (*Blue Vitriol. Copper Vitriol.*) Effloresces on the surface. Soluble in 2.34 pts. of water at 18°; or 100 pts. of water at 18° dissolve 42.7 pts. of it; or the aqueous solution saturated at 18° contains 29.8% of it, or 19.1% of the anhydrous salt, and is of 1.2147 sp. gr. (H. Schiff, *Ann. Ch u. Pharm.*, 1859, **109.** 326. See also his alcohol table below.)

1 pt. of the crystallized salt is soluble in

[3.32	pts. of	water at	4° (cited in Gm.)]
2.70	"	"	18.75°
1.85	"	"	31.25°
1.70	"	"	37.50°
1.14	"	"	50°
1.28	"	"	62.5°
1.09	"	"	75°
0.78	"	"	87.5°
0.55	"	"	100°
0.49	"	"	103.7° (boiling point of the saturated aqueous solution).

Or 100 pts. of water at

18.75°	dissolve	37	pts. of the cryst. salt.
31.25°	"	54	"
37.50°	"	59	"
50°	"	87	"
62.5°	"	78	"
75°	"	92	"
87.5°	"	129	"
100°	"	181	"
103.7°	"	209	"

(Brandes & Gruner, from *Trommsdorff's N. Journn. der Pharm.*, 1826, vol. **12,** in *Brandes's Archiv.*, 1827, **22.** 169.)

100 pts. of water at °C.	Dissolve pts. of the anhyd. salt, CuO, SO_3.	pts. of the cryst. salt, $CuO, SO_3 + 5 Aq$.
0°	18.20	31.61
10°	20.92	36.95
20°	23.55	42.31
30°	26.63	48.81
40°	30.29	56.90
50°	34.14	65.83
60°	38.83	77.39
70°	45.06	94.00
80°	53.15	118.03
90°	64.23	156.44
100°	75.35	203.32

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** 467.)

0°	17.
20°	24.3
35°	28.6
54°	36.1

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

15.5° . . . 45.352

[T.]

100 pts. of the aqueous solution saturated at its boiling point (102.2°) contain 45 pts. of the dry salt; or 100 pts. of water, at 102.2°, dissolve 81.82 pts. of it; or 1 pt. of the dry salt is soluble in 1.222 pts. of water at 102.2°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) The aqueous solution saturated at 17.5° is of 1.182 sp. gr., it contains 29.3% of the salt; or 100 pts. of water at 17.5° dissolve 41.45 pts. of the hydrated salt; or 1 pt. of the salt is soluble in 2.412 pts. of water at 17 5. (Karsten, *Berlin Abhandl.*, 1840, p. 101.) Soluble in somewhat less than 4 pts. of water at a moderate heat, but much more soluble in boiling water. (Bergman, *Essays*, **1.** 183.) Soluble in 4 pts. of cold, and in 2 pts. of boiling water, the saturated cold solution containing 20% of it, and the saturated boiling solution 33.33%. (Schubarth, *Tech. Chem.*, & M. R. & P.) The aqueous solution saturated at 15° is of 1.185913 sp. gr., and contains dissolved in every 100 pts. of water at least 33.103 pts. of the crystallized salt. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.)

The aqueous solution saturated
at ? contains 5.5% of it (Mussembrock);
at 10° " 52.9 " (Eller); and
at 12.5° " 25 " (Hassenfratz, *Ann. de Chim.*, **28.** 291.)

When strongly heated it melts in its water of crystallization. The hot aqueous solution is liable to become supersaturated on cooling. (Fischer, *Schw.*, **12.** 187 [*Gm.*]; Coxe.) The aqueous solution saturated at 8° is of 1.17 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24.** 210.)

A solution of sp. gr. at 12.5°.	Contains percent of sulphate of copper.
1.0141	2
1.0280	4
1.0413	6
1.0539	8
1.0660	10
1.0795	12
1.0938	14
1.1083	16
1.1230	18
1.1380	20
1.1513	22
1.1747	24

(Hassenfratz, *Ann. de Chim.*, **28.** 297.)

An aqueous solution of sp. gr. (at 18°).	Contains (by experiment) percent of $Cu O, S O_3 + 5 Aq.$
1.2147	29.89
1.1355	19.97
1.0649	9.96
1.0423	6.64
1.0210	3.32

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 335.)

From these results Schiff calculates the following table by means of the formula: $D = 1 + 0.0063 p + 0.000014 p^2 + 0.000000483 p^3$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 18°).	Percent of $Cu O, S O_3 + 5 Aq.$	Percent of anhydr. $Cu O, S O_3$
1.0063	1	0.637
1.0126	2	1.275
1.0190	3	1.912
1.0254	4	2.550
1.0319	5	3.187
1.0384	6	3.825
1.0450	7	4.462
1.0516	8	5.100
1.0582	9	5.737
1.0649	10	6.375
1.0716	11	7.012
1.0785	12	7.650
1.0854	13	8.287
1.0923	14	8.925
1.0993	15	9 562
1.1063	16	10.200
1.1135	17	10.837
1.1208	18	11.474
1.1281	19	12.111
1.1354	20	12.750
1.1427	21	13.387
1.1501	22	14.025
1.1585	23	14.662
1.1659	24	15.300
1.1738	25	15.938
1.1817	26	16.574
1.1898	27	17.211
1.1980	28	17.848
1.2063	29	18.486
1.2146	30	19.125

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110.** 71.)

It begins to be insoluble in spirit of 0.905 sp. gr., so that 4000 pts. of this spirit scarcely dissolve 1 pt. of it. (Anthon, *J. pr. Ch.*, **14.** 125.)

A solution (saturated at 15°) in alcohol of sp. gr.	percent by weight.	Contains percent of $Cu O, S O_3 + 5 Aq.$
1.000	0	27.2
0.986	10	13.3
0.972	20	3.1
0.939	40	0.25

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.)

Soluble in glycerin (Pelouze); and in picolin (Unverdorben). Soluble in chlorhydric acid, with reduction of temperature. (Kane.) Sulphate of copper is completely precipitated from its aqueous solution on the addition of glacial acetic acid. (Persoz, *Chim. Moléc.*, p. 346; also *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

Sulphate of copper is soluble in a saturated aqueous solution of sulphate of soda. (Karsten, *loc. cit.*) When an excess of a mixture of sulphate of copper and sulphate of soda is treated with water at 0°, 100 pts. of the latter dissolve 14.349 pts. of anhydrous mixed salt; viz., 8.038 pts. of $Cu O, S O_3$; and 6.311 pts. of $Na O, S O_3$; relations very different from these, however, obtain when the water is present in excess. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 227.)

Sulphate of copper is slowly and sparingly soluble in a saturated aqueous solution of sulphate of magnesia, but if this solution is evaporated the two salts separate out almost simultaneously. (Karsten, *loc. cit.*, p. 125.) When an excess of a mixture of sulphate of copper and sulphate of magnesia is treated with water at 0°, 100 pts. of the latter dissolve 30.473 pts. of the anhydrous mixed salts, viz. 6.559 pts. of $Cu O, S O_3$, and 23.914 pts. of $Mg O, S O_3$. When an excess of water is employed relations very different from these are obtained. (Pfaff, *loc. cit.*) When an excess of a mixture of sulphate of copper, sulphate of magnesia, and sulphate of soda is treated with water at 0°, 100 pts. of the latter dissolve 35.318 pts. of anhydrous mixed salt, viz. 7.169 pts. of $Cu O, S O_3$, 21.319 pts. of $Mg O, S O_3$, and 6.830 pts. of $Na O, S O_3$. Very different relations are obtained, however, when an excess of water is employed. (Pfaff, *loc. cit.*)

Sulphate of copper is tolerably rapidly soluble in a saturated aqueous solution of sulphate of potash, but only to form a double salt, which separates out. (Karsten, *loc. cit.*, p. 127.) It is exceedingly slowly soluble in a saturated aqueous solution of sulphate of zinc, with formation of a double salt, which separates out. (Karsten, *loc. cit.*)

Soluble in a saturated aqueous solution of chloride of sodium; difficultly soluble in a saturated solution of chloride of ammonium, a double sulphate of copper and ammonia meanwhile separating out. (Karsten, *loc. cit.*, p. 128.)

Slowly soluble in a saturated solution of nitrate of potash, with formation of a double sulphate, which separates out; very slowly soluble in a saturated solution of nitrate of soda, with separation of a double sulphate. (Karsten, *loc. cit.*, pp. 129, 130.)

II.) *di.* Insoluble in water. (Thomson.)

III.) *tri.* Insoluble in water. (Berzelius.)
$3 Cu O, S O_3 + 3 Aq$

IV.) *tetra.* Insoluble in water. (Proust.) Soluble, with considerable facility, in an aqueous solution of sulphate of ammonia, and also, though perhaps not
$4 Cu O, S O_3 + 4 Aq$

to so great an extent, in solutions of chloride of ammonium and of nitrate of ammonia, the more readily as these are more concentrated. (Lea, *Am. J. Sci.*, (2.) **31.** 190.) The native compound (*Brochantite,* = $4\ Cu\ O, S\ O_3 + 3\ Aq$) is insoluble in water, but soluble in acids.

V.) *penta.* Ppt.
$5\ Cu\ O, S\ O_3 + 5\ Aq$

VI.) *octo.* Ppt.
$8\ Cu\ O, S\ O_3 + 12\ Aq$

Sulphate of Copper & of Cuprammonium.
$Cu\ O, S\ O_3 ; N \left\{ \begin{matrix} H_3 \\ Cu \end{matrix} \right. . O, S\ O_3$

Sulphate of Copper & of Ethylamin.

Sulphate of Copper & *of protoxide* of Iron.
$4\,(Cu\ O, S\ O_3) ; Fe\ O, S\ O_3 + 34\ Aq$ 100 pts. of water at 15.5° dissolve 75.91 pts. of it. (Thomson, in his *System of Chem.*, London, 1831, **2.** 770.)

Other compounds of the two salts have been described, as $Cu\ O, S\ O_3 ; 2\ (Fe\ O, S\ O_3) + 20\ Aq$ (Volland); $Cu\ O, S\ O_3 ; 3\ (Fe\ O, S\ O_3) + 28\ Aq$ (Lefort), &c., &c. They are all soluble in water.

Sulphate of Copper & *of sesquioxide* of Iron.
$Cu\ O, S\ O_3 ; Fe_2\ O_3, 3\ S\ O_3 + 24\ Aq$ Soluble in water. (Bastick.)

Sulphate of Copper, *of protoxide* of Iron, & of Nickel. Efflorescent. (Link.)

Sulphate of Copper, of Iron, & of Potash.
$Cu\ O, S\ O_3 ; Fe\ O, S\ O_3 ; 2\,(K\ O, S\ O_3) + 12\ Aq$ Soluble, without decomposition, in water free from air. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 61.)

Sulphate of Copper & of Magnesia.
$Cu\ O, S\ O_3 ; Mg\ O, S\ O_3 + 2\ Aq\ \&\ 6\ Aq\ \&\ 14\ Aq$ The 2 Aq salt is permanent (Arrot); but the 14 Aq salt is efflorescent. Soluble in water. (Scacchi.) If the aqueous solution is allowed to evaporate spontaneously, the component salts always crystallize apart, the double salt being entirely decomposed, but if the solution, — or any mixed solution of $Cu\ O, S\ O_3$, and $Mg\ O, S\ O_3$, — be evaporated at a temperature above 38°, the salt $Cu\ O, S\ O_3 ; Mg\ O, S\ O_3 + 2\ Aq$ is deposited as a crystalline crust. On boiling the aqueous solution a basic (with Cu O) salt is precipitated. (Arrot, *Phil. Mag.*, 1844, (3.) **24.** 502.)

Sulphate of Copper, of Magnesia, of Manganese, & of Potash.
$Cu\ O, S\ O_3 ; Mg\ O, S\ O_3 ; Mn\ O, S\ O_3 ; 3\,(K\ O, S\ O_3) + 18\ Aq$

Sulphate of Copper, of Magnesia, & of Potash.
$Cu\ O, S\ O_3 ; Mg\ O, S\ O_3 ; 2\,(K\ O, S\ O_3) + 12\ Aq$

Sulphate of Copper, of Magnesia, of Potash, & of Zinc.
$Cu\ O, S\ O_3 ; Mg\ O, S\ O_3 ; 3\,(K\ O, S\ O_3) ; Zn\ O, S\ O_3 + 18\ Aq$ Soluble in water. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 71.)

Sulphate of Copper, of Manganese, & of Potash.
$Cu\ O, S\ O_3 ; Mn\ O, S\ O_3 ; 2\,(K\ O, S\ O_3) + 12\ Aq$

Sulphate of Copper & of Nickel.
$Cu\ O, S\ O_3 ; Ni\ O, S\ O_3 + 7\ Aq$ Soluble in water.

Sulphate of Copper, of Nickel, & of Potash.
$Cu\ O, S\ O_3 ; Ni\ O, S\ O_3 ; 2\,(K\ O, S\ O_3) + 12\ Aq$ Permanent. Soluble in 4 pts. of water. Insoluble in alcohol. (Bette.)

Sulphate of Copper & of Potash.

I.) $Cu\ O, S\ O_3 ; K\ O, S\ O_3 + 6\ Aq$ Permanent. Readily soluble in water. Less soluble in water than bisulphate of potash. When the salt is pure its solution may be boiled, or repeatedly crystallized, without decomposition, but if an excess of sulphate of potash or of salt No. II. be present, the solution will be decomposed when heated to 60°, with deposition of the difficultly soluble double salt No. II. (Persoz, *Ann. Ch. et Phys.*, (3.) **25.** 272.) 100 pts. of the aqueous solution saturated at its boiling point (102.8°) contains 40 pts. of the dry salt; or 100 pts. of water at 102.8 dissolve 66.666 pts. of it; or 1 pt. of the dry salt is soluble in 1.5 pt. of water at 102.8°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) Much more soluble in hot than in cold water. (Pierre, *Ann. Ch. et Phys.*, (3.) **16.** 251.) Easily soluble in water. (A. Vogel.)

II.) $4\,(Cu\ O, S\ O_3) ; K\ O, S\ O_3 + 4\ Aq$ Very sparingly soluble in cold water. (Persoz, *Ann. Ch. et Phys.*, (3.) **25.** 271.) Decomposed by washing with water. (Graham.)

III.) $3\,(Cu\ O, S\ O_3) ; K\ O, S\ O_3 ; Cu\ O + 4\ Aq$ When boiled with water the normal double salt (No. 1) is dissolved out, while basic sulphate of copper remains. (Brunner.)

Sulphate of Copper, of Potash, & of Zinc.
$Cu\ O, S\ O_3 ; 2\,(K\ O, S\ O_3) ; Zn\ O, S\ O_3 + 12\ Aq$ Permanent.

Sulphate of Copper & of Soda.
$Cu\ O, S\ O_3 ; Na\ O, S\ O_3 + 2\ Aq$ Deliquescent. Decomposed by water. (Graham.) Permanent. Soluble in water. When the aqueous solution is evaporated at 55° the salt crystallizes out as such. At 100° it is decomposed, an insoluble basic salt being precipitated. When the solution is allowed to evaporate spontaneously the component salts crystallize out separately. (Arrot.) Very easily soluble in water. (Karsten, *Berlin Abhandl.*, 1840, p. 120.)

Sulphate of Copper & of Strychnine.

Sulphate of Copper & of Zinc.
$Cu\ O, S\ O_3 ; 3\ Zn\ O, S\ O_3 + 28\ Aq$ Efflorescent. 100 pts. of water at 8° dissolve 80 pts. of it; it is soluble in all proportions in boiling water. (Lefort, *Ann. Ch. et Phys.*, (3.) **23.** 102.)

Sulphate of Corydalin. Readily soluble in water.

Sulphate of Creatin.
$N_3 \left\{ \begin{matrix} (C_2\ O_2'')_2 \\ C_4\ H_5 \\ H_4 \end{matrix} \right. . H\ O, S\ O_3$ Permanent. Soluble in water. (Dessaignes.)

Sulphate of Creatinin. Readily soluble in warm alcohol.

Sulphate of Cumidin.
$N \left\{ \begin{matrix} C_{18}\ H_{11} \\ H_2 \end{matrix} \right. . H\ O, S\ O_3$ Slightly soluble in water; more soluble in alcohol. (Nicholson, *J. Ch. Soc.*, **1.** 6.)

Sulphate of Cupr(*ic*)ammonium.
$N \left\{ \begin{matrix} H_3 \\ Cu \end{matrix} \right. . O, S\ O_3$ Decomposed by water, with precipitation of $4\ Cu\ O, S\ O_3$. (Kane.)

Sulphate of Cuminamate of Ethyl. Easily soluble in water, and alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 340.)

Sulphate of Cuminamic Acid.
$N \left\{ \begin{matrix} C_{20}\ H_{11}\ O_2 \\ H_2 \end{matrix} \right. . O, H\ O, S\ O_3$ Sparingly soluble in cold, easily soluble in boiling water. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 337.)

Sulphate of Cupr(*ic*)Anilin. Decomposed $N\left\{\begin{matrix}C_{12}H_5\\H_2.Cu\end{matrix}\right..O,SO_3$ by boiling water, but may be washed with cold water.

Sulphate of Curarin.

Sulphate of CyanAnilin. Extremely soluble in water. The solution is decomposed by evaporation. (Hofmann, *J. Ch. Soc.*, **1.** 166.)

Sulphate of Cyanethin. Very soluble in water. Soluble in alcohol. (Kolbe & Frankland, *J. Ch. Soc.*, **1.** 72.)

Sulphate of Cyanetholin. Soluble in water.

Sulphate of CyanhydroHarmalin. Soluble in water acidulated with sulphuric acid.

Sulphate of CyanoCodein. Sparingly soluble in water. The solution is easily decomposed.

Sulphate of Cymidin. Soluble in water. (Barlow.)

Sulphate of Cystin.

Sulphate of Delphin. Soluble in water.

Sulphate of Didymium.

I.) *normal.*

a = anhydrous. Quickly soluble in water, when DiO,SO_3 it is added to the water by small portions and agitated. When the cold saturated solution is heated to 53° the hydrated salt separates out in large quantity, and the more readily as the temperature is elevated, so that 1 pt. of the salt requires 50.5 pts. of boiling water to retain it in solution.

b = hydrated. Rather slowly, but abundantly, soluble in cold water. Soluble in about 5 pts. of water at 15° @ 18°. (Mosander, in *Berzelius's Lehrb.*, **3.** 530.) Very readily soluble in 5 @ 6 pts. of water, but is precipitated again if the aqueous solution is heated above 30° @ 35°. (Marignac (citing Mosander), *Ann. Ch. et Phys.*, (3.) **27.** 224.) "The solubility of sulphate of didymium is different according as one dissolves the anhydrous salt, or one of the hydrates."

100 pts. of water dissolve of anhydrous sulphate of didymium,

At °C.	When anhydrous sulphate, DiO, SO_3, is used, pts.	When $DiO, SO_3 + 2Aq$ is used, pts.	When $DiO, SO_3 + 3Aq$ is used, pts.
12° . .	43.1		
14°	39.3*		
18°	25.8 . . .	16.4	
19°			11.7
25°	20.6		
38°	13.0		
40°			8.8
50° . .	11.0		6.5
100°			1.7

The sulphate with two equivalents of water attains its maximum solubility only after the lapse of a very long space of time. Thus, at the temperature of 18°, 13 pts. were dissolved in 100 pts. of water after 24 hours, and 16.4 pts. after standing a second day. On evaporating this solution in a vacuum, until the greater part of the salt had crystallized,† the mother liquor was found to contain 34 pts. of sulphate for 100 pts. of water. It appears thus to attain the solubility of the anhydrous salt. (Marignac, *loc. inf. cit.*)

Sulphate of didymium is more soluble than sulphate of lanthanum in a neutral solution, but is less soluble than the latter in an acid solution. (Watts, *J. Ch. Soc.*, **2.** 145.)

II.) *basic.* Completely insoluble either in cold $3\,DiO,SO_3$ or in boiling water. Difficultly soluble in dilute chlorhydric acid, even when this is boiling. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 170.)

Sulphate of Didymium & of Potash. $3(DiO,SO_3);KO,SO_3+2Aq$ Soluble in 63 pts. of water. (Marignac, *loc. cit.*, p. 174.) Totally insoluble in a saturated aqueous solution of sulphate of potash [?]. (Mosander.) Oxide of didymium cannot be completely precipitated by sulphate of potash. The precipitated double salt is not soluble in cold chlorhydric acid, but is slightly soluble in boiling chlorhydric acid. (H. Rose, *Tr.*)

Sulphate of Didymium & of Soda. Sol- $3(DiO,SO_3);NaO,SO_3$ uble in about 200 pts. of water; still less soluble in an aqueous solution of sulphate of soda. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 173.)

Sulphate of Etherin. *Vid.* EthylSulphate of Wine-Oil.

Sulphate of Ethyl.

I.) *Vid.* EthylSulphuric Acid.
$C_4H_5O,HO,2SO_3$

II.) *Vid.* EthylSulphate of Ethyl.
$2C_4H_5O,SO_3$

III.) *tris.* Decomposed by water. (Blondeau.)
"$3C_4H_5O,SO_3$"

Sulphate of Ethyl & of Carburetted Hydrogen. *Vid.* EthylSulphate of Wine-Oil.

Sulphate of Ethyl & of Etherol. *Vid.* EthylSulphate of Wine-Oil.

Sulphate of Ethylamin. Deliquescent. $N\left\{\begin{matrix}C_4H_5\\H_2\end{matrix}\right..HO,SO_3$ Very soluble in alcohol. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **30.** 484.)

Sulphate of Ethylamin & of Magnesia. $N\left\{\begin{matrix}C_4H_5\\H_2\end{matrix}\right..HO,SO_3;MgO,SO_3+7Aq$ Soluble in water. (E. Meyer.)

Sulphate of *tetra*Ethylammonium. Deli- $N\left\{(C_4H_5)_4.O,SO_3\right.$ quescent.

Sulphate of *di*EthylAmylamin. Deliquescent.

Sulphate of *tri*EthylAmylamin.

Sulphate of EthylAnilin. Readily soluble in water, and alcohol.

Sulphate of EthylChlorAnilin. More soluble than the salts of chlor-anilin.

Sulphate of EthylCyanAnilin. Soluble in water.

Sulphate of EthylNicotin. Soluble in water. (v. Planta & Kekulè, *Ann. Ch. u. Pharm.*, **87.** 6.)

Sulphate of *tri*EthylPhenylammonium.

Sulphate of *tetra*EthylPhosphonium. Deliquescent. Soluble in water, and alcohol. Insoluble in ether.

Sulphate of *di*EthylPlatin*bi*ammonium. (Corresponding to the 1st Base of Reiset.) $N_2\left\{\begin{matrix}(C_4H_5)_2\\Pt\\H_3\end{matrix}\right..HO,SO_3$ Soluble in water, from which it is precipitated on the addition of alcohol. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **30**. 487.)

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* "This number must be too high, since the solution was maintained at this temperature only half an hour." (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 170.)

† These crystals were those of the $\frac{8}{3}$ hydrate.

SULPHATE OF ETHYLQUININE.

I.) *normal.* Much less soluble in water, but more soluble in alcohol than the acid salt.

$N_2\{C_{40}H_{23}(C_4H_5)O_4^{VI}.HO,SO_3+8Aq$

II.) *acid.* Very easily soluble in water. Sparingly soluble in alcohol. (Strecker.)

$N_2\{C_{40}H_{23}(C_4H_5)O_4^{VI}.HO,HO,2SO_3+4Aq$

SULPHATE OF ETHYLSTRYCHNINE. Less soluble than the chlorhydrate in water.

SULPHATE OF FLUORIDE OF BORON. Insoluble in water. (J. Davy.)

BFl_2SO_3

SULPHATE OF FURFURIN.

I.) *normal.*

II.) *acid.* Efflorescent. Readily soluble in water, less soluble in alcohol or ether, and still less soluble in water acidulated with sulphuric acid. (Svanberg & Bergstrand.)

SULPHATE OF FUSCOCOBALT(*iaque*). Soluble in water. Insoluble in ammonia-water. Alcohol precipitates it from the aqueous solution. (Fremy, *Ann. Ch. et Phys.*, (3.) **35**. 290.)

$4NH_3.Co_2O_3,2SO_3+4Aq$

SULPHATE OF GLAUCIN. Readily soluble in water, and alcohol. Insoluble in ether.

SULPHATE OF GLAUCOPICRIN.

SULPHATE OF GLUCINA.

I.) *normal.* Easily soluble in water. Less readily soluble in acidulated water, from which it crystallizes more easily than from pure water. Insoluble in alcohol. (Berzelius, in his *Lehrb.*, **3**. 493.) Easily soluble in water. Insoluble in absolute alcohol. (Weeren.) Soluble in about 1 pt. of water at 14°; the solubility increases with the temperature, and boiling water dissolves it in almost all proportions. The presence of sulphuric acid renders it less soluble in cold water. Tolerably soluble in alcohol, unless this is absolute, though much less soluble in alcohol than in water. (Debray, *Ann. Ch. et Phys.*, (3.) **44**. 25.) Sulphate of glucina may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63**. 444.) The crystals effloresce in warm air, and melt in their water of crystallization when heated.

$Gl_2O_3,3SO_3+12Aq$

II.) *mono.* Insoluble in water, after it has been ignited. (Berzelius.) Soluble in water, but the concentrated aqueous solution is decomposed on the addition of much water. (Debray, *loc. cit.*) An aqueous solution of sulphate of glucina may be rendered nearly tribasic by the addition of an alkali, but the product will not bear large dilution with water. (Ordway, *Am. J. Sci.*, (2.) **26**. 207.)

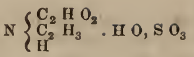
Gl_2O_3,SO_3

SULPHATE OF GLUCINA & OF POTASH. Sparingly soluble in cold, much more, though still slowly, soluble in hot water. (Debray, *Ann. Ch. et Phys.*, (3.) **44**. 29.) It dissolves very slowly, though in considerable quantity, in water. (Awdejew.)

$3(KO,SO_3);Gl_2O_3,3SO_3+6Aq$

SULPHATE OF GLYCOCOLL.

I.) Permanent. Soluble in water, and in warm dilute spirit. Insoluble in absolute alcohol, or in ether. (Horsford, *Am. J. Sci.*, (2.) **4**. 58.)



$N\left\{\begin{matrix}C_2HO_2\\C_2H_3\\H\end{matrix}\right..HO,SO_3$

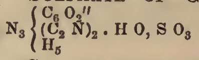
II.) *Several basic compounds.* (See Horsford's Memoir, *loc. cit.*)

SULPHATE OF GLYCOCOLL & OF POTASH. Soluble in water, from which it is precipitated by cold alcohol. Soluble in warm dilute alcohol. (Horsford, *loc. cit.*, p. 69.)

"$C_4H_4NO_3,SO_3;C_4H_4NO_3,KO,SO_3$"

SULPHATE *of teroxide* OF GOLD. Known only in sulphuric acid solution; this is decomposed, with separation of metallic gold, on the addition of water. (Pelletier, *Ann. Ch. et Phys.*, (2.) **15**. 12.)

SULPHATE OF GUANIN. Decomposed by much water. Insoluble in alcohol.



$N_3\left\{\begin{matrix}C_6O_2''\\(C_2N)_2\\H_5\end{matrix}\right..HO,SO_3$

SULPHATE OF GUANIN & OF SILVER. Ppt.

SULPHATE OF HARMALIN.

I.) *peracid.* Very soluble in water.

SULPHATE OF HARMIN.

I.) *normal.*

$N_2\{C_{26}H_{12}O_2^{VI}.HO,SO_3+2Aq$

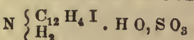
II.) *bi.* Soluble in boiling alcohol.

$N_2\{C_{26}H_{12}O_2^{VI}.HO,HO,2SO_3$

SULPHATE OF IGASURIN. Much less soluble than the chlorhydrate in water. Soluble in about 4 pts. of boiling, and in about 10 pts. of cold water.

SULPHATE OF INDIGO. *Vid.* SulphIndigotic Acid.

SULPHATE OF IODANILIN. Only slightly soluble in cold, somewhat more soluble in hot water. It appears to undergo partial decomposition when the aqueous solution is boiled. Soluble in alcohol. Insoluble in ether. (Hofmann, *J. Ch. Soc.*, **1**. 277.)



$N\left\{\begin{matrix}C_{12}H_4I\\H_2\end{matrix}\right..HO,SO_3$

SULPHATE OF IODOCINCHONICIN. Soluble in spirit. (W. B. Herapath, *Phil. Mag.*, (4.) **16**. 65.)

I.) SULPHATE OF IODOCINCHONIDIN(of Wittstein). (Herapath, *Phil. Mag.*, (4.) **16**. pp. 56, 64.)

II.) SULPHATE OF IODOCINCHONIDIN(of Pasteur).

a = active. Soluble in boiling, less soluble in cold spirit. When crystals of this salt are allowed to remain in their mother liquor with an excess of less than 1% of sulphuric acid they undergo transformation, the salt with 9 Aq being formed.

"$C_{57}H_{33}N_2O_5I_3,HO,2SO_3+5Aq$"

b = silky needles, feebly active. Soluble in boiling spirit, but as this solution cools, the active, 5 Aq, salt separates out.

"$C_{57}H_{33}N_2O_5I_3,HO,2SO_3+9Aq$"

c = olive colored. Soluble in boiling spirit, but as this solution cools, the active, 5 Aq, salt separates out. (W. B. Herapath, *Phil. Mag.*, (4.) **16**. 59.)

"$C_{57}H_{33}N_2O_5I_3,HO,2SO_3+3Aq$"

As a class, the iodo-salts [sulphates] of the cinchona alkaloids all agree in being more or less soluble in spirit, from which they are precipitated on the addition of water; they are only slightly soluble in dilute spirit, and scarcely at all soluble in water, ether, oil of turpentine, or chloroform. Acetic, dilute sulphuric, or chlorhydric acids have but little action upon them, whilst nitric acid and concentrated sulphuric and chlorhydric acid, and alkaline solutions, decompose them. (Herapath, *loc. cit.*, **16.** 56.)

Sulphate of IodoCinchonin. $C_{33}H_{19}N_2O_2I, HO, SO_3 + 6Aq$ Far more soluble in spirit than the corresponding compounds of quinine, quinidin, or cinchonidin. (Herapath, *Phil. Mag.*, (4.) **16.** pp. 64, 63.)

As a class, the iodo-salts [sulphates] of the cinchona alkaloids all agree in being more or less soluble in spirit, from which they are precipitated on the addition of water; they are only slightly soluble in dilute spirit, and scarcely at all soluble in water, ether, oil of turpentine, or chloroform. Acetic, dilute sulphuric, or chlorhydric acids have but little action upon them, whilst nitric acid and concentrated sulphuric or chlorhydric acid, and alkaline solutions, decompose them.

The cinchonin and quinidin salts dissolve with more difficulty [than the others], in consequence of their greater thickness and less extent of surface. (Herapath, *loc. cit.*, **16.** 56.)

Sulphate of IodoQuinicin. Very soluble in spirit, from which it is readily precipitated on the addition of water. (W. B. Herapath, *Phil. Mag.*, (4.) **16.** 65.)

Sulphate of IodoQuinidin. $C_{35}H_{19}N_2O_4I_2, HO, SO_3 + 5Aq$ Soluble in 121 pts. of spirit at 16.67°, and in 31 pts. of boiling spirit. Water precipitates it from the alcoholic solution. (W. B. Herapath, *Phil. Mag.*, (4.) **16.** 62; and (4.) **14.** 225.)

As a class, the iodo-salts [sulphates] of the cinchona alkaloids all agree in being more or less soluble in spirit, from which they are precipitated on the addition of water; they are only slightly soluble in dilute spirit, and scarcely at all soluble in water, ether, oil of turpentine, or chloroform. Acetic, dilute sulphuric, or chlorhydric acids have but little action upon them, whilst nitric acid, and concentrated sulphuric or chlorhydric acid, and alkaline solutions, decompose them.

The quinidin and cinchonin salts dissolve with more difficulty [than the others], in consequence of their greater thickness and less extent of surface. (Herapath, *loc. cit.*, **16.** 56.)

Sulphate of IodoQuinine.
(*Herapathite.*)
" $C_{57}H_{33}N_2O_5\dot{I}_2, HO, 2SO_3 + 5Aq$ "
(Herapath's later analysis)
$N_2\left\{C_{40}H_{24}O_4^{VI}.I_2, O, HO, 2SO_3 + 10Aq\right.$
(Herapath's earlier analysis.)

Soluble in about 1000 pts. of boiling water. Very sparingly soluble in water, ether, or oil of turpentine, and does not appear to be any more soluble in boiling ether or oil of turpentine; requiring, in any case, about 2000 pts. of either of these liquids for its solution. Insoluble in chloroform. Soluble in 650 pts. of alcohol, of 0.837, at 13.8°, and in 50 pts. of the same alcohol at boiling. Soluble in 750 pts. of acetic acid, of 1.042 sp. gr., at 15.5°, and in 60 pts. of the same acid when boiling, with partial decomposition after a time. Insoluble in cold, easily soluble in hot dilute sulphuric acid of 1.0682 sp. gr. Readily soluble in sulphuric acid of 1.845 sp. gr. Scarcely at all acted upon by dilute, but is decomposed by concentrated chlorhydric acid. Decomposed by alkaline solutions, and by nitric acid, even in the cold. (W. B. Herapath, *Phil. Mag.*, (4.) **9.** 366.)

As a class, the iodo-salts [sulphates] of the cinchona alkaloids all agree in being more or less soluble in spirit, from which they are precipitated on the addition of water; they are only slightly soluble in dilute spirit, and scarcely at all soluble in water, ether, oil of turpentine, or chloroform. Acetic, dilute sulphuric, or chlorhydric acids have but little action upon them, whilst nitric acid and concentrated sulphuric or chlorhydric acid, and alkaline solutions, decompose them. (Herapath, *Phil. Mag.*, (4.) **16.** 56.)

Sulphate *of protoxide* **of Iridium.** IrO, SO_3 Soluble in water. (Berzelius.)

Sulphate *of sesquioxide* **of Iridium.** Soluble in nitric acid.

Sulphate *of binoxide* **of Iridium.** $IrO_2, 2SO_3$ Easily soluble in water, and alcohol. (Berzelius.)

Sulphate *of protoxide* **of Iron.**

I.) *mono.*

a = FeO, SO_3

100 pts. of water at °C	Dissolve of the anhydrous salt, FeO, SO_3, pts.
0°	15.8
10°	19.9
12°	21.3
20°	26.0
21°	27.4
30°	32.6
37°	36.5
45°	42.9
55°	47.0
70°	56.5

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

The aqueous solution saturated at its boiling point (102.2°) contains 64% of the dry salt; or 100 pts. of water at 102.2° dissolve 177.778 pts. of it; or 1 pt. of the dry salt is soluble in 0.5625 pt. of water at 102.2°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.)

When sulphate of protoxide of iron is slightly calcined, it is rendered, not less soluble, but less easily soluble in water. (Barreswil, *C. R.*, **20.** 1366.)

b = $FeO, SO_3 + Aq$

c = $FeO, SO_3 + 2Aq$ As sparingly soluble as gypsum. (Mitscherlich.)

d = $FeO, SO_3 + 3Aq$ Soluble in water. (Kane.)

e = $FeO, SO_3 + 4Aq$ Separates from concentrated aqueous solutions at 80°.

f = $FeO, SO_3 + 7Aq$
(*Ordinary commercial Sulphate of Iron. Green Vitriol. Copperas.*)

Pure compact crystals, thoroughly freed from mother liquor and well dried, remain permanent for a long time in dry air, and for a tolerably long time in damp air.

Soluble in 1.66 pt. of water at 17°; or 100 pts. of water at 17° dissolve 60.0 pts. of it; or the aqueous solution saturated at 17° contains 37.5% of it, or 20.4% of the anhydrous salt, and is of 1.2232 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.)

Soluble in	1.642	pt. of water	at	10°
“	1.432	“	“	15°
“	0.868	“	“	25°
“	0.655	“	“	32.5°
“	0.440	“	“	46.25°
“	0.376	“	“	60°
“	0.394	“	“	70°
“	0.375	“	“	83.75°
“	0.270	“	“	90°
“	0.300	“	“	*100°

Or 100 parts of water

at 10°	dissolve	60.8	pts. of $\mathrm{Fe\,O\,S\,O_3}$
15°	“	69.8	“ [+ 7 Aq
25°	“	115.1	“
32.5°	“	152.2	“
46.25°	“	227.1	“
60°	“	265.9	“
70°	“	253.4	“
83.75°	“	269.8	“
90°	“	370.3	“
*100°	“	332.9	“

Or the aqueous solution saturated at °C	Contains percent of $\mathrm{Fe\,O,\,S\,O_3}$ + 7 Aq
10°	37.84
15°	41.11
25°	53.51
32.5°	60.35
46.25.	69.43
60°	72.67
70°	71.71
83.75°	72.96
90°	78.74
*100°	76.89

(R. & W. Brandes, *Brandes's Archiv.*, 1824, **7.** 83, and fig.) When the 7 Aq salt is boiled with an amount of water insufficient to dissolve the whole of it, a new white hydrate is formed and separates out. In this respect sulphate of iron resembles sulphate of soda (with 10 Aq), and, as is the case with the latter, the slow increase and final decrease of its solubility as the temperature rises may be regarded as due to a change of composition. (R. & W. Brandes, *loc. cit.*) An aqueous solution saturated at 15° contains 37.2% of it. (H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.) Like sulphate of protoxide of manganese, its solubility in water increases with the temperature up to a certain point, 87.5°, and then diminishes as the temperature is increased, although in spite of this it is much more soluble at 100° than at 15°. (Brandes, *Pogg. Ann.*, 1830, **20.** 581, citing his earlier memoir, in the *Archiv.*, **7.** 88.)

Soluble in 2 pts. of cold, and in 1 pt. of boiling water (Fourcroy); in 2 pts. of water at 18.75° (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201; in Canstatt's *Jahresbericht für* 1854, p. 76); in 6 pts. of water at a moderate heat, and in 0.75 pt. of boiling water. (Bergman, *Essays*, **1.** 184.) 100 pts. of water at 15.5° dissolve 45 @ 50 pts. of it. (Ure's *Dict.*) The aqueous solution saturated at 10° contains 51.5% of it (Eller); in the cold, 33.33% (Fourcroy); at 12.5°, 33.5%. (Hassenfratz, *Ann. de Chim.*, **28.** 291.)

After a warm aqueous solution has deposited crystals on cooling, a fresh quantity of the latter may generally be produced by opening the vessel and shaking it, a certain amount of supersaturation being liable to occur. (Coxe.) The crystals melt in their water of crystallization when heated, and when this solution is evaporated to dryness a white powder is obtained (*b* ?), which dissolves in water very slowly. (Berzelius, *Lehrb.*)

An aqueous solution of sp. gr. (at 12.5°)	Contains percent of the [crystallized] salt.
1.0096	2
1.0203	4
1.0314	6
1.0436	8
1.0560	10
1.0696	12
1.0829	14
1.0961	16
1.1095	18
1.1220	20
1.1358	22
1.1498	24
1.1638	26
1.1781	28
1.1920	30
1.12031	32

(Hassenfratz, *Ann. de Chim.*, **28.** 297.)

An aqueous solution of sp. gr. (at 17.2°)	Contains (by experiment) percent of $\mathrm{Fe\,O,\,S\,O_3}$ + 7 Aq
1.2332	37.50
1.1473	25.00
1.0943	16.67
1.0693	12.50
1.0450	8.34
1.0220	4.17

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 335.) From these results Schiff calculates the following table by means of the formula: $D = 1 + 0.005175\,p + 0.00003043\,p^2 - 0.0000000682\,p^3$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 17.2°).	Percent of $\mathrm{Fe\,O,\,S\,O_3}$ + 7 Aq	Anhydr. $\mathrm{Fe\,O,\,S\,O_3}$.
1.0052	1	0.547
1.0105	2	1.094
1.0158	3	1.641
1.0212	4	2.188
1.0266	5	2.735
1.0321	6	3.282
1.0377	7	3.829
1.0433	8	4.376
1.0490	9	4.923
1.0547	10	5.470
1.0605	11	6.017
1.0664	12	6.564
1.0723	13	7.111
1.0782	14	7.658
1.0842	15	8.205
1.0903	16	8.752
1.0964	17	9.299
1.1026	18	9.846
1.1088	19	10.393
1.1151	20	10.940
1.1214	21	11.487
1.1278	22	12.034
1.1343	23	12.581
1.1408	24	13.128
1.1473	25	13.675
1.1539	26	14.222
1.1606	27	14.769
1.1673	28	15 316
1.1740	29	15.863
1.1808	30	16.410
1.1876	31	16.957
1.1945	32	17.504
1.2014	33	18.051
1.2084	34	18.598

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* When the solution saturated at 87.5° is heated to 100° it becomes covered with a crystalline crust. In determining the solubility at 100° considerable difficulty is consequently experienced in obtaining a clear liquid. In attempting to do this, in the recorded instance, the temperature of the solution fell to 91.25°, at which it was quite clear; this was again heated to 100°, at which temperature another portion of the salt separated out, and a part of the liquid was decanted for the experiment above given.

Sp. gr. at 17.2°)	Percent of $FeO, SO_3 + 7 Aq$	Anhydr. FeO, SO_3.
1.2154	35	19.145
1.2225	36	10.692
1.2296	37	20.239
1.2368	38	20.786
1.2440	39	21.333
1.2513	40	21.880

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110**. 73.) A solution in alcohol of 40% by weight, or 0.939 sp. gr., saturated at 15°, contains 0.3% of it. (H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118**. 365.) Insoluble in spirit of 0.905, or less, sp. gr. (Anthon, *J. pr. Ch.*, **14**. 125.) When boiled with alcohol, the quadri-hydrated salt (*e*) is deposited. (Mitscherlich.) From the aqueous solution, strong alcohol precipitates one of the lower hydrates. But the 7-hydrated salt crystallizes from dilute spirit acidulated with sulphuric acid. (Berthemot.) Concentrated sulphuric acid also precipitates one of the lower hydrates from the aqueous solution.

Sulphate of protoxide of iron may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63**. 444), so completely that no trace of it is left in the liquid. (Persoz, *Chim. Moléc.*, pp. 346, 348.) The aqueous solution becomes turbid when exposed to the air, a basic salt of the sesquioxide being deposited. After a certain quantity of this sediment has separated out, the solution undergoes scarcely any further change. When tolerably dilute, it will be found to contain only an insignificant amount of sesquioxide; hence all of this oxide which forms must be separated as a basic salt. (Otto-Graham.) Soluble in hot chlorhydric acid, the solution yielding crystals both of the 7 hydrated and also of the terhydrated salt (*d*), on cooling. (Kane.) Somewhat soluble in concentrated sulphuric acid. (Bussy & Lecanu.)

II.) *sesqui.* Sparingly soluble in water. $2 FeO, 3 SO_3 + 7 Aq$ (Bonnsdorff.)

SULPHATE *of sesquioxide* OF IRON.

I.) *normal* or *ter.*

a = *anhydrous.* Very slowly soluble in water, $Fe_2O_3, 3 SO_3$ being frequently as difficultly soluble as burnt alum.

Rapidly soluble in an aqueous solution of sulphate of protoxide of iron, not only in tolerably strong solutions, but also in solutions which contain only a very small quantity of the protoxide salt, the reaction being analogous to that which occurs between the two chlorides of chromium. (Barreswil, *C. R.*, 1845, **20**. 1366.)

$b = Fe_2O_3, 3 SO_3 + 9 Aq$ Deliquescent, soluble in water.

The concentrated aqueous solution does not become turbid on boiling, but diluted solutions are decomposed by ebullition, with separation of an insoluble basic salt, and this decomposition is more complete in proportion as the solution is more dilute. If the solution is exceedingly dilute, the basic salt will separate at temperatures below that of ebullition. (Scheerer; H. Rose, *Pogg. Ann.*, **83**. 147.) A solution of 1 pt. of the salt in 100 pts. of water becomes cloudy when heated to 76°; in 200 pts. of water, at 56°; in 400 pts., at 47°; in 800 pts., at 40°; in 1000 pts., at 38°; and in 10000 pts., at 14°. If one pt. of the salt be dissolved in 200 pts. of water, one half of the oxide of iron is precipitated on boiling, if in 400 pts. then $\frac{3}{4}$ of the oxide of iron is precipitated, if in 800 pts. then $\frac{7}{8}$ of it is precipitated, if in 1000 pts. then about $\frac{9}{10}$ of it is precipitated. (Scheerer.) [This precipitation occurs even in acid solutions, if they are sufficiently dilute.]

Largely soluble in alcohol. (Wenzel, in his *Verwandtschaft*, p. 300 [T.].) Readily soluble in spirit. (Bergman, *Essays*, **1**. 184.) Being the only metallic sulphate, with the exception of that of binoxide of platinum, which is readily soluble in alcohol. (L. Gmelin.) Completely insoluble in concentrated sulphuric acid.

Sulphate of sesquioxide of iron may be completely precipitated from its aqueous solution by the addition of a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63**. 444.)

An aqueous solution of sesquisulphate of iron, especially if it contains a little free acid, is capable of dissolving most of the metals, from silver down to those which have the greatest affinity for oxygen, when these are digested or boiled with it, the sesquioxide being meanwhile reduced to protoxide. (Berzelius, *Lehrb.*, **3**. 614.)

II.) *bi.*

$a = Fe_2O_3, 2 SO_3$ Soluble in water, but the solution soon decomposes, especially when boiled, or diluted with much water. (Maus; Berzelius, in his *Jahresbericht*, **14**. 201.)

$b = Fe_2O_3, 2 SO_3 + 10 Aq$ Occurs as the mineral *Stypticite.* Decomposed by cold water, with separation of a basic salt. (H. Rose.)

Compounds as basic as $Fe_2O_3, 2 SO_3$ may be obtained completely dissolved in water. (Ordway, *Am. J. Sci.*, 1858, (2.) **26**. 202.)

III.) *sesquibasic.* The native compound (*fibroferrite*) is partially soluble in cold, more readily soluble in boiling water. (Prideaux.)
$2 Fe_2O_3, 3 SO_3 + 18 Aq$

IV.) *mono.* Ppt.
$Fe_2O_3, SO_3 + 3 Aq$

V.) *di.* When precipitated from cold solutions $2 Fe_2O_3, SO_3 + 6 Aq$ it is soluble in a concentrated solution of $Fe_2O_3, 3 SO_3$, but is insoluble therein when it has been precipitated from hot solutions. (Maus.)

VI.) *tri.* Insoluble in water, tolerably soluble $3 Fe_2O_3, SO_3 + 4 Aq$ in acids. (Th. Scheerer.)

VII.) *hexa.* Insoluble in water. Slowly soluble $6 Fe_2O_3, SO_3 + 10 Aq$ in warm chlorhydric acid. (Th. Scheerer.)

SULPHATE *of protoxide & of sesquioxide* OF IRON.

I.) Soluble in water. (Berzelius, *Lehrb.*)
$FeO, SO_3; Fe_2O_3, 3 SO_3$

II.) Absorbs moisture and oxidizes in the air.
$3 (FeO, SO_3); 2 (Fe_2O_3, 3 SO_3) + 4 Aq$ Soluble in water acidulated with sulphuric acid. Insoluble in alcohol. (Abich.)

III.) (Poumarède.)
$FeO, SO_3; 6 Fe_2O_3, 3 SO_3 + 10 Aq$

IV.) Soluble in water. (Berzelius, *Lehrb.*, **3**. 621.)
$3 FeO, 2 SO_3; 3 (Fe_2O_3, 2 SO_3) + 36 Aq$

SULPHATE *of protoxide* OF IRON & OF MAGNESIA. Permanent. Soluble in water; if the solution is allowed to evaporate spontaneously, the component salts always crystallize apart, the double salt being entirely decomposed, but if the solution, — or any mixed solution of FeO, SO_3 and MgO, SO_3, — be evaporated at a temperature above 38°, the salt
$FeO, SO_3; MgO, SO_3 + 4 Aq$ & $14 Aq$

$FeO, SO_3; MgO, SO_3 + 4 Aq$ crystallizes out. (Arrott, *Phil. Mag.*, 1844, (3.) **24.** 502.)

Sulphate *of protoxide* of Iron, of Magnesia, & of Potash.
$FeO, SO_3; MgO, SO_3; 2(KO, SO_3) + 12 Aq$

Sulphate *of protoxide* of Iron, of Manganese, & of Potash.
$FeO, SO_3; MnO, SO_3; 2(KO, SO_3) + 12 Aq$
Tolerably easily soluble in water. (Vohl, *Ann. Ch. u. Pharm.*, **94.** 67.)

Sulphate *of protoxide* of Iron, & of Nickel. Efflorescent.

Sulphate *of protoxide* of Iron, of Nickel, & of Potash.
$FeO, SO_3; NiO, SO_3; 2(KO, SO_3) + 12 Aq$

Sulphate *of protoxide* of Iron, & of Potash.
$FeO, SO_3; KO, SO_3 + 6 Aq$
Less soluble in water than protosulphate of iron. (Link.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	19.6
10°	25.4
14.5°	29.1
16°	30.9
25°	36.5
35°	41.0
40°	45.0
55°	56.1
65°	59.3
70°	64.2

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198 and fig.)

Sulphate *of sesquioxide* of Iron, & of Potash.

I.) *normal.*

a = $Fe_2O_3, 3SO_3; KO, SO_3 + Aq$

b = $Fe_2O_3, 3SO_3; KO, SO_3 + 3 Aq$

c = $Fe_2O_3, 3SO_3; KO, SO_3 + 24 Aq$
(Potash Iron Alum.)
Soluble in 5 pts. of water at 12.5°. (Anthon.) The salt is decomposed to No. 4 when heated above 80°, and a similar decomposition occurs when the aqueous solution is heated to 80°. When the aqueous solution is mixed with sulphuric acid, and evaporated on the water-bath, the terhydrated salt (*b*) separates out as soon as a certain degree of concentration has been attained, and as the acid becomes more concentrated the monohydrated salt (*a*) is precipitated. (Berzelius, *Lehrb.*) Insoluble in alcohol. (Dumas, *Tr.*)

II.) Insoluble in water, by which, however, it
$2(Fe_2O_3, 3SO_3); KO, SO_3$
is gradually decomposed. (Grimm & Ramdohr, *Ann. Ch. u. Pharm.*, **98.** 131.)

III.) Soluble in a neutral solution of potash
$Fe_2O_3, 2SO_3; KO, SO_3 + 3 Aq$
iron alum, but is decomposed by water. (Dumas, *Tr.*, **7.** 85.)

IV.) Soluble in 6 pts. of cold water, with
$Fe_2O_3, 2SO_3; 2(KO, SO_3) + 6 Aq$
subsequent decomposition. (Maus.) Soluble in 12.75 pts. of water at 10°; but the solution is decomposed on boiling. (Anthon.)

V.) While yet moist it is soluble in water, but
$3(Fe_2O_3, 2SO_3); 2(KO, SO_3) + 20 Aq$
after having become dry it is decomposed by water. The aqueous solution is decomposed on standing, or quickly by boiling. Insoluble in alcohol. (Soubeiran.)

VI.) Insoluble in water.
$3(2Fe_2O_3, 3SO_3); KO, SO_3 + 18 Aq$

VII.) Insoluble in boiling water. Slightly sol-
$4(Fe_2O_3, SO_3); KO, SO_3 + 9 Aq$
uble in chlorhydric acid, more readily soluble in aqua-regia. (Rammelsberg.)

Sulphate *of protoxide* of Iron, of Potash, & of Zinc.
$FeO, SO_3; 2(KO, SO_3); ZnO, SO_3 + 12 Aq$

Sulphate *of sesquioxide* of Iron, & of Quinine. Nearly insoluble in water. (Parrish's *Pharm.*, p. 509.) Soluble in water, and alcohol.

Sulphate of Iron & of Silver.

I.) Ppt.
$2Fe_2O_3, SO_3; 7(2AgO, SO_3)$

II.) Soluble in 1000 pts. of water. (Lavini.)
$2Fe_2O_3, SO_3; 18(2AgO, SO_3)$

Sulphate *of protoxide* of Iron & of Soda.
$FeO, SO_3; NaO, SO_3 + 4 Aq$
Permanent. Soluble in water. It crystallizes out as such when the aqueous solution is evaporated at 55°; but when the solution is allowed to evaporate spontaneously the component salts crystallize out separately. (Arrott.)

Sulphate *of sesquioxide* of Iron & of Soda.
$4(Fe_2O_3, SO_3); NaO, SO_3 + 9 Aq$
Insoluble in water. Sparingly soluble in chlorhydric acid. (Th. Scheerer.)

Sulphate *of protoxide* of Iron & of Zinc.
$FeO, SO_3; ZnO, SO_3 + 14 Aq$
Permanent. As soluble as sulphate of zinc. (Thomson.)

Sulphate of Jervin. Very sparingly soluble in water, and the mineral acids. Soluble in alcohol.

Sulphate of Lanthanum.

I) *normal.*

a = *anhydrous.* Much less soluble in *warm* than in cold water. When the anhydrous salt in fine powder is added by small portions to water, the temperature of which is 2° @ 3°, and agitated therewith while the vessel which contains the mixture is cooled so that the temperature shall not rise above 13°, 1 pt. of the salt dissolves in less than 6 pts. of water, and so long as the temperature is no higher than 13° this solution may be preserved unchanged. But if the solution be heated to 30° a 3-hydrated salt begins to separate out, and in the course of a few minutes the solution will have become almost completely solid. Even when the solution is cooled, as soon as the crystallization has commenced, this will not be retarded, but goes on as before, until completed; and when a solution is heated to 12° @ 14° at a single point, the crystallization spreads at once through the portions of the solution which have not been warmed. (Mosander, in Berzelius's *Lehrb.*, **3.** 528.)

b = *hydrated.* Soluble in 42.5 pts. of water at
$? + 3 Aq$
23°, and 115 pts. of water at 100°. (Mosander, Berzelius's *Lehrb*) The anhydrous salt is easily soluble in water at 5° @ 6°, but at higher temperatures the solution is readily precipitated, even when heated to less than 30°. (Marignac (citing Mosander), *Ann. Ch. et Phys.*, (3.) **27.** 224.) Sulphate of lanthanum is less soluble than sulphate of didymium in a neutral solution, but is more soluble than the latter in an acid solution. (Watts, *J. Ch. Soc.*, **2.** 145.) At a strong red heat sulphate of lanthanum is converted into an insoluble basic salt, half of its acid being expelled.

Sulphate of Lanthanum & of Potash. Sparingly soluble in water. Almost insoluble in a saturated aqueous solution of sulphate of potash. (Mosander.)

Sulphate of Lead. PbO, SO_3 Soluble in 13000 pts. of water at 15°. (Kremers, *Pogg. Ann.*, **85.** 247.) More soluble than sulphate of baryta, less soluble than sulphate of strontia in water. Soluble in 22816 pts. of water at 11°, and in 36504 pts. of water acidulated with sulphuric acid. Much more soluble in solutions of ammoniacal salts, from which, however, it is reprecipitated on adding an excess of sulphuric acid, so that in a solution containing a considerable quantity of nitrate of ammonia, and some acetate of ammonia which had been strongly acidulated with sulphuric acid, scarcely any more of it was found dissolved than if the ammonia salts had not been present. (Fresenius, *Ann. Ch. u. Pharm.*, 1846, **59.** 125.) Soluble in 1200 pts. of water, but is more soluble in water containing nitric acid. (Kirwan, in his *Mineralogy*, **2.** 211 [T.].) Scarcely at all soluble in water or acetic acid. (Bergman, *Essays*, **1.** 140.) No more soluble in water acidulated with acetic acid than in pure water. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1827, **51.** 230.) 1 pt. of ignited sulphate of lead dissolves, at 12.5°, in 172 pts. of dilute nitric acid of 1.144 sp. gr. On adding to 1054 grains of this solution 12 ounces of water, by small portions, no precipitate was produced at any time; the dilute solution thus obtained afforded a precipitate when treated with free sulphuric acid. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1827, **51.** pp. 233 – 237.)

Insoluble, or almost insoluble, in absolute alcohol, and in spirit. Of the ammonia salts, the nitrate, acetate, and tartrate are especially well fitted to serve as solvents of sulphate of lead, the two last named should be made strongly alkaline by adding ammonia before they are used. (Wackenroder.) Soluble in hot concentrated chlorhydric acid. Soluble in nitric acid, the more readily in proportion as this is more concentrated or warmer. It is not reprecipitated from the nitric acid solution by the addition of water, but is precipitated by dilute sulphuric acid when this is added in sufficient quantity. Sparingly soluble in concentrated sulphuric acid, from which it is partially precipitated by diluting with water, or completely by adding alcohol. Easily soluble in hot potash, or soda-lye. (Fresenius, *Quant.*, p. 143.)

Difficultly, but completely, soluble, and in no inconsiderable quantity, in dilute nitric acid. From this solution it may be reprecipitated by adding a sufficient quantity of dilute sulphuric acid, but not by solutions of alkaline sulphates, or at least only incompletely, nor is any precipitate produced by chlorhydric or phosphoric acids. Tartaric acid, on the other hand, when added in sufficient quantity, occasions a precipitate. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** pp. 319, 320.) Slightly soluble in warm nitric acid, but not when the acid is dilute. (H. Rose, *Tr.*)

Concentrated sulphuric acid dissolves 0.005 pt. of sulphate of lead. (Ure, *Quar. J. Sci.*, 1817, **4.** 118.) More soluble in the oil of vitriol of commerce than in a more concentrated acid, but below this it is less soluble the more dilute the acid is. (Hayes.) Soluble in a warm solution of caustic ammonia, separating out on cooling. (Wittstein.)

When recently precipitated it is somewhat soluble even in a cold aqueous solution of chloride of ammonium, but may be completely reprecipitated by adding an excess of caustic ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 99.) Soluble in an aqueous solution of chloride of ammonium at 12.5° @ 25°, the filtered solution deposits crystals of chloride of lead. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 183.) Readily soluble in aqueous solutions of chloride of ammonium and of nitrate of ammonia. (Bolley, *Ann. Ch. u. Pharm.*, **91.** 115.) Soluble in aqueous solutions of acetate and nitrate of ammonia; 1 pt. of the ignited salt dissolving at 12.5° in 47 pts. of a solution of acetate of ammonia of 1.036 sp. gr.; and in 969 pts. of a concentrated solution of nitrate of ammonia of 1.29 sp. gr. From the solution in acetate of ammonia the sulphate of lead may be reprecipitated, for the most part, by adding an excess of free sulphuric acid, or sulphate of potash; from the solution in nitrate of ammonia an excess of sulphate of potash precipitates the sulphate of lead almost entirely, but free sulphuric acid occasions no precipitate. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1827, **51.** pp. 231 – 233, 236.) Soluble in an aqueous solution of acetate of ammonia at 18.8° @ 25°, and is not precipitated by a small quantity of sulphuric acid from a solution of acetate of lead mixed with acetate of ammonia. When the solution of sulphate of lead in acetate of ammonia is evaporated to dryness at a gentle heat, the residue may be completely redissolved by a small quantity of water. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 182.) Soluble in an aqueous solution of sulphate of ammonia. (H. Rose, *Tr.*) Also soluble in a hot solution of succinate of ammonia. (Wittstein.) Easily soluble in aqueous solutions of the acetates of ammonia, soda, potash, lime, alumina, and magnesia. (Mercer, *Rep. Br. Assoc.*, 1844, p. 32.) Very easily and abundantly soluble in an aqueous solution of normal tartrate of ammonia, a concentrated solution coagulating, after a time, to a stiff jelly. (Wœhler, *Ann. Ch. u. Pharm.*, 1840, **34.** 235.) Even when in its native crystalline condition, it is readily soluble in an aqueous solution of citrate of ammonia. (J. Lawrence Smith, *Proc. Amer. Assoc.*, and *Am. J. Sci.*, (2.) **20.** 244.) Slightly decomposed by a solution of chloride of sodium. (Bley.) 1 litre of water saturated with chloride of sodium, marking 25° B., dissolves about 0.66 grm. of sulphate of lead; on being left to itself this solution deposits crystals of a double compound of chloride and sulphate of lead in the course of several days. (Becquerel, *C. R.*, 1845, **20.** 1523.) Completely soluble in a tolerably concentrated aqueous solution of hyposulphite of soda, especially if this be heated to 30° @ 36°, but at the temperature of boiling, and at the ordinary temperature after a time, a certain amount of decomposition ensues. (Lœwe, *J. pr. Ch.*, 1858, **74.** 348.) Insoluble in a solution of acetate of lead. (J. Lawrence Smith, *Am. J. Sci.*, (2.) **16.** 54.) Not precipitated from solutions containing the normal tartrates, or acetate of soda. (Spiller.)

Sparingly soluble in hot chlorhydric acid. (Hayes.) Tolerably abundantly soluble in concentrated chlorhydric acid, especially when this is hot: crystals of chloride of lead separate from this solution as it cools. (Berzelius, *Lehrb.*) It does not dissolve in cold dilute chlorhydric acid. (H. Rose, *Tr.*) Soluble in 172 pts. of nitric acid, of 1.144 sp. gr., at 12.5°. (Bischof.) Water does not render this solution turbid, but sulphuric acid precipitates it completely; it is likewise precipitated by carbonate of ammonia. (Bischof.) Dilute nitric acid also dissolves it, though slowly;

the solution is not precipitated by phosphoric or chlorhydric acid, and but very slightly, if at all, by alkaline sulphates; it is precipitated, however, by tartaric acid, and more especially by dilute sulphuric acid. (Wackenroder, *Ann. Pharm.*, **41.** 319.) Soluble in nitric acid, from which nitrate of lead precipitates a portion of it. (Gladstone.) Slightly soluble in warm concentrated acids, from which it is precipitated in part by water.

No more soluble in a solution of sulphate of zinc acidulated with sulphuric acid than it is in the latter by itself. (Eliot & Storer, *Mem. Amer. Acad.*, 1860 (N. S.), **8.** 61.)

Decomposed when boiled with aqueous solutions of the carbonates of potash, soda, and ammonia, with formation of insoluble carbonate of lead. (Persoz, *Chim. Moléc.*, p. 384.) Decomposed by an aqueous solution of carbonate of ammonia. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236; in *J. pr. Ch.*, 1837, **11.** 183.) Decomposed by long-continued boiling with solutions of those alkaline salts the acids of which form sparingly soluble compounds with lead, as, for example, the alkaline carbonates, oxalates, and chromates, but it is not easy to attain complete decomposition in this manner. (Berzelius, *Lehrb.*, **3.** 720.) Completely decomposed, even at ordinary temperatures, by solutions of the mono and bicarbonates of the alkalies. The former dissolve some oxide of lead in this case, the latter none. (H. Rose, *Pogg. Ann.*, **95.** 426.) An equivalent of sulphate of lead may be completely decomposed by an equivalent of an alkaline carbonate in aqueous solution. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 347.) About equally soluble with carbonate of lead in water, but much more soluble than the latter in alkaline solutions. (Dulong, *Ann. de Chim.*, **82.** 290.) More soluble than chloride of lead in alkaline solutions. (Berthollet.) 1 pt. of nitrate of lead still gives a precipitate with sulphuric acid in presence of 20000 pts. of water (Pfaff; Harting); and with sulphate of soda in 25000 pts. of water. (Lassaigne.)

Sulphate of Lead & of Potash. Slowly decomposed by water. (Trommsdorff.)

Sulphate of Lead & of Soda.

Sulphate of Leucin. Soluble in concentrated sulphuric acid; less soluble, or insoluble, in absolute alcohol.

Sulphate of Lime.

I.) *anhydrous.* Unites with water very slowly.
CaO, SO_3 Totally insoluble in water at about 150°. (Cousté, *Ann. des Mines*, 1854, (5.) **5.** 144, *note* [see also under No. 3]; Sullivan, *Rep. Br. Assoc.*, 1857, p. 59.) Sulphate of lime is precipitated in the anhydrous state from superheated liquors. (De Senarmont, *Ann. Ch. et Phys.*, 1850, (3.) **30.** 145.) Anhydrite is soluble in 492.2 pts. of water at 15° @ 20°. (Tipp.)

II.) Less soluble than ordinary gypsum in wa-
$2(CaO, SO_3) + Aq$ ter. [Has been studied by Johnston; also by Millon, *Ann. Ch. et Phys.*, (3.) **19.** 221; compare Cousté, *inf.*]

III.) Permanent.
(*Gypsum.*)
$CaO, SO_3 + 2\,Aq$

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	0.205
5°	0.219
12°	0.233
20°	0.241
30°	0.249
35°	0.254
40°	0.252
50°	0.251
60°	0.248
70°	0.244
80°	0.239
90°	0.231
100°	0.217

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** pp. 469, 471.)

When a solution of sulphate of lime, even if very dilute, is heated to 100° or higher, a considerable precipitate will be formed. (Graham, *Phil. Mag.*, 1827, (2.) **2.** 23; see also No. I.) Soluble in 388.3 pts. of water at 15° @ 20°, whether gypsum or anhydrite are taken for the experiment. (Tipp, cited in Wittstein's *Handw.*)

Soluble in 380 pts. of cold, and 388 pts. of boiling water (Giese); in 500 pts. of water, either hot or cold (Fourcroy); in 500 pts. of water at a moderate heat, and in 450 pts. of boiling water (Bergman, *Essays*, **1.** 180); in 461 pts. of water at the ordinary temperature, and in from 458 to 461.4 pts. of boiling water, i. e. it is equally soluble at the ordinary temperature and at boiling, as is also proved by the fact that the hot aqueous solution deposits nothing on cooling. (Bucholz, *Gehlen's Neues all. Journ. der Chemie*, 1805, **5.** 164.) Soluble in 332 pts. of water at all temperatures (Lassaigne); this statement has been contradicted by Poggiale (*vid. supra*), who asserts that the maximum solubility is at +35°, at which temperature 1 pt. of the salt dissolves in 393 pts. of water; the solubility decreases on elevating or depressing the temperature, so that at 0° 1 pt. of the salt is soluble in 488 pts. of water, and at 100° 1 pt. is soluble in 460 pts. of water.

Soluble in 438 pts. of water. (Anthon, *Pharm. Centrallblatt*, 1847, p. 827.) 100 pts. of water at 15.5° dissolve 0.2 pt. of it, and at 100°, 0.22 pt. (Ure's *Dict.*) Soluble in 250 @ 300 pts. of water (Dumas, *Tr.*, **6.** 276); more soluble in water acidulated with sulphuric, chlorhydric, or nitric acids.

More soluble in aqueous solutions of chloride of ammonium than in pure water. (A. Vogel.) When a solution of sulphate of lime in chloride of ammonium is evaporated and then set aside to cool, or when the solution is allowed to evaporate spontaneously, a quantity of the sulphate of lime separates out, pure and in well-formed crystals. (Storer.) More soluble in an aqueous solution of chloride of sodium than in pure water. (Trommsdorff.) Very easily soluble in an aqueous solution of chloride of sodium, and is not reprecipitated on the addition of dilute sulphuric acid. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.) Soluble in 122 pts. of a saturated aqueous solution of chloride of sodium. (Anthon.) Insoluble in concentrated aqueous solutions of chloride of sodium, but is, nevertheless, more soluble in dilute solutions than it is in pure water. (Dumas, *Tr.*, **6.** 153.) The maximum solubility of sulphate of lime in saline water (at least in that of the saline at Moutiers) is in that of 1.033 sp. gr.

In a liquor marking °B.	Are dissolved pts. of sulphate of lime.
0°	0.0033
2°	0.0043
5°	0.00605 (maximum)
15°	0.0043
27°	0.0000

(Berthier, cited by Dumas, *Tr.*, **6.** 335.)

Less soluble in hot than in cold water, or sea-water. At temperatures superior to 100° the solubility of sulphate of lime in sea-water diminishes very nearly proportionally to the augmentation of temperature.

Solubility of Sulphate of Lime in Sea-water at Temperatures above 103°.

At °C.	Under a pressure of atmospheres.	Sea-water saturated with CaO, SO_3	
		Marks °B. (at 15° C).	Contains in solution percent of CaO, SO_3.
103.00°	1	12.5°	0.500
103.80°	1	12°	0.477
105.15°	1	11°	0.432
108.60°	1.25	10°	0.395
111.00°	1.25	9°	0.355
113.20°	1.25	8°	0.310
115.80°	1.50	7°	0.267
118.50°	1.50	6°	0.226
121 20°	1.50	5°	0.183
124.00°	2	4°	0.140
127.90°	2	3°	0.097
130.00°	2.5	2°	0.060
133.30°	2.5	1°	0.023

This table expresses, for example, the fact that when sea-water is boiled under a pressure of 1 atmosphere, or at 103°, it will become saturated with sulphate of lime when its density has been elevated to 12.5° B., and will then contain 0.5% of the sulphate; at 1.25 atmosphere, or 108.6°, the water will be saturated with sulphate when it marks 10° B., and will then contain 0.395% of this salt; at a pressure of 2 atmospheres, or 124°, sea-water, in its natural state, and without having been subjected to any concentration, is very near the point at which saturation occurs, for this natural water marks 3° @ 3.5° B., and in the cited case saturation occurs at a concentration of 4°. (Cousté, *loc. infra cit.*) Sulphate of lime becomes completely insoluble, either in fresh or sea-water, at temperatures between 140° and 150°. If a solution of it be exposed to these temperatures the whole of the sulphate will be precipitated either in small crystals or very thin films, according as it is more or less abundant in the solution.* The sulphate thus precipitated redissolves after the solution has cooled, but so much the more slowly in proportion as the temperature at which it was precipitated is more elevated. That which has been precipitated at 150° requires several (5 @ 6) days in order to redissolve, and this even when the proportion of the precipitate is very small as compared with that of the water. (Cousté, *Ann. des Mines*, 1854, (5.) **5.** pp. 80, 140 - 144.)

All that has been said concerning the solubility of sulphate of lime in sea-water at temperatures above 130° applies as well to fresh water. (Cousté, *loc. cit.*, p. 144.)

Since sulphate of lime is not deposited from its solution in sea-water until this has arrived at a certain degree of concentration, i. e. 12° @ 13° B., when the ebullition is effected in free air, it would seem as if all incrustation of steam-boilers fed with sea-water might be prevented by maintaining the water in the boiler at a state of concentration inferior to the degree which corresponds to its saturation with sulphate of lime. A result which would be attained by evacuating the water of the boiler, in such proportion, relatively to the water injected, that the quantity of sulphate of lime thrown out shall be at least equal to the quantity of sulphate introduced in the feed-water. That is to say, P being the weight of the water injected in a given time, p that of the water evacuated in the same time; n the proportion of the sulphate of lime contained in the feed-water, N the analogous proportion in water concentrated to such an extent as to be saturated with sulphate of lime; it would be sufficient to make $p > \frac{n}{N} P$.

In order that this principle may be applicable it is evidently necessary that $\frac{n}{N}$ must be a small fraction. A condition which is tolerably well fulfilled by sea-water, for, admitting all the lime to be in the state of sulphate, natural sea-water, or that at 3° B. contains 0.097 percent of sulphate of lime, and this same water, brought to a state of saturation as regards the sulphate, by boiling down in free air, i. e. to 12.5° B., contains 0.5 percent of sulphate of lime. In this case, then, $\frac{n}{N} = \frac{0{\cdot}097}{0{\cdot}500}$ or $< \frac{1}{5}$.

But N diminishes rapidly in proportion as the temperature, or pressure, at which the ebullition takes place is increased. Its value is still tolerably large when the ebullition occurs under a pressure of 1.25 atmosphere (109°), which is the case with low-pressure boilers, but for pressures above 2 @ 3 atmospheres (121° and 135°) the values of N are inferior to those of n.

As for fresh waters, the principle of evacuation is inapplicable to them, because, on the one hand, they dissolve very little sulphate of lime (less than 0.003 percent in the cold), and, on the other, they always contain carbonate of lime, against which evacuation is of no service.

It is therefore necessary to conclude that the principle of evacuation is only applicable to boilers fed with sea-water, and even then only to those which are worked at low pressures. But in practice this theoretical assumption is not completely efficacious, it being found that, while evacuation hinders incrustation of those parts of the boiler which are *indirectly* heated, i.e. heated only by the contact of smoke and gaseous products of combustion, it is powerless to prevent the incrustation of the surface which is heated *directly*, by the radiant heat of the fire and contact of the flame; for the heat being very intense in the latter case, the layer of water next in contact with the walls of this portion of the boiler is heated above the limit of concentration, and deposits some of its sulphate. (Cousté, *Ann. des Mines*, 1854, (5.) **5.** pp. 82, *et seq.*, 145 - 147.)

[A remarkable feature in the precipitation of sulphate of lime from its solutions when these are heated, and which appears to have been overlooked by previous observers, is the fact that, when once the precipitation has been commenced by the application of heat, *it will continue long after the source of heat has been removed and the temperature has fallen to that of ordinary air.* Thus, in one of many experiments, a quantity of brine from the salt-works at Syracuse, N. Y., was heated in a small close boiler during five minutes to 143°. On allowing the liquor to flow out at this temperature it was very cloudy, like milk, from suspended sulphate of lime. One portion of it was filtered hot, another portion after it had become cold, and in both instances the clear filtrate became blue in the course of a few minutes, and at the end of 24 hours had deposited a large quantity of an amorphous powder. The bearing of this point upon the question of evacuating steam-boilers is obvious. (Storer, unpublished experiments made in 1857.).]

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* In experimenting upon the point at which sulphate of lime is completely insoluble Cousté added to 100 cc. of distilled water 2 drops of sea-water (natural), marking 4.25° B., each drop forming 0.068 cc., and the two drops consequently containing $2 \times 0.068 \times 0.0015 = 0.0002$ cc. of sulphate of lime; the mixture therefore containing 0.000002 of this salt. A portion of this mixture being exposed in a sealed tube to a temperature of 140° during 15 minutes, a deposit of exceedingly thin films of sulphate of lime could be detected floating in the liquid.

A similar experiment was made with a mixture of 100 cc. of distilled water and 2 drops of another mixture containing $\frac{1}{40}$ of sea-water. The mixture employed consequently contained a proportion of sulphate of lime expressed by the equation $\frac{0.068 \times \frac{2}{40} \times 0.0015}{100} = 0.00000005$. At the end of 30 minutes the presence of minute pellicles, like those of the previous experiment, was detected.

Sulphate of lime may consequently be considered as totally insoluble in sea-water, and *à fortiori*, in fresh water, at temperatures between 140° and 150°. When a solution of carbonate of lime in an aqueous solution of sulphate of ammonia, or of sulphate of soda, potash, or magnesia, is gradually heated to 130° @ 140°, crystals of sulphate of lime separate out, and the liquid becomes alkaline. (Cousté, *loc. cit.*, pp. 143, 144.)

More soluble in solutions of sulphate of soda (O. Henry), and succinate of ammonia (Wittstein), than in pure water. Soluble to a very considerable extent in an aqueous solution of acetate of ammonia at 18.8° @ 25°, especially when recently precipitated. An ounce of the solution of acetate of ammonia (*Liquor ammonii acetici* of the Prussian pharmacopœa) dissolves nearly 10 grains of sulphate of lime. (Weppen, from *Arch. d. Pharm.*, (2.) **9.** 236, in *J. pr. Ch.*, 1837, **11.** 182.) Also much more abundantly soluble in a solution of chloride of ammonium at 12.5° @ 25° than in pure water, but is less soluble therein than in a solution of acetate of ammonia. (Weppen, *Ibid.*, *J. pr Ch.*, p. 183.) When recently precipitated it dissolves in an aqueous solution of chloride of ammonium, though less speedily and perhaps less completely than carbonate or phosphate of lime. A solution of nitrate of ammonia acts much in the same way as that of chloride of ammonium. (Brett, *Phil. Mag.*, 1837, (3.) **11.** 96.) Slightly soluble in an aqueous solution of sulphate of magnesia (but not readily soluble, as in a solution of sulphate of soda). (Bergman, *Essays*, **1.** pp. 395, 442.) No more soluble in an aqueous solution of carbonic acid than in pure water. (J. Davy.)

[In view of a statement by Risler, in Gasparin's *Agronomie*, to the effect that sulphate of lime is much more soluble in the extract of garden earth, which he had studied in connection with Verdeil, than in pure water, I was led several years since to make the following approximative experiments, hoping thereby to arrive at some conclusion which might be interesting in an agricultural point of view. It will be observed that Risler's statement was not corroborated.*

When mixed at the temperature of 15° @ 20° with a solution of	1 pt. of Ca O, S O_3 was dissolved by pts. of the solution.	The solution contained percent of Ca O, S O_3.
Distilled water . .	446.9	0.224
Extract of earth	485.5	0.205
Cane-sugar (containing a little lime)	300.1	0.333
Fe O, S O_3	393.6	0.253
Putrid urine	480.2	0.208

A sample of crude sulphate of ammonia liquor (containing N H_4 S; N H_4 Cy, &c.), prepared in the large way at a manufactory by mixing gypsum with the ammoniacal liquor of gas-works, contained 0.232% of Ca O, S O_3, i. e. 1 pt. of Ca O, S O_3 was soluble in 430.7 pts. of the solution of impure sulphate of ammonia. (F. H. S.)]

More freely soluble in a concentrated aqueous solution of sulphate of ammonia (1 pt. salt to 4 pts. of water) than in pure water. Such a solution produces no precipitate in a solution of a lime salt, neither in the cold nor on boiling. (H. Rose.) More freely soluble in aqueous solutions of sesquichloride of iron, sesquichloride of chromium, protochloride of copper and chloride of zinc, than in pure water; but no more soluble in a solution of chloride of calcium than in water. (Gladstone.) When neutral aqueous solutions of hyposulphite of lime and sulphate of alumina are mixed a somewhat copious precipitate of sulphate of lime subsides, but at the same time a portion of each of the mixed salts remains undecomposed in the solution. (Herschel, *Edin. Phil. Journ.*, 1819, **1.** 22.) Rather easily and completely soluble at the ordinary temperature in a saturated aqueous solution of hyposulphite of soda, and more readily at the temperature of boiling. On the addition of alcohol to this solution all the lime is precipitated as a double hyposulphite. On adding crystals of hyposulphite of soda to a mixture of water and sulphate of lime it was found that more than ten times as much of the latter was dissolved as could have been taken up by the water alone. (Diehl, *J. pr. Ch.*, 1860, **79.** 430.)

Sulphate of lime is not precipitated at ordinary temperatures when dilute solutions of chloride of calcium and sulphate of magnesia are mixed, but precipitation takes place when the mixed solutions are heated. Even in tolerably concentrated solutions some time elapses before precipitation commences at the ordinary temperature. (R. Brandes, *Schweigger's Journ.*, 1825, **43.** 157.) If a solution containing 7⅓ pts. of chloride of calcium in 100 pts. of water be mixed with a solution containing 7⅓ pts. of sulphate of magnesia in 100 pts. of water, no precipitate of sulphate of lime will be formed, although 5.75 pts. of Ca O, S O_3 are present in the 200 pts. of water, and, as has just been stated, more than 400 pts. of water are required to dissolve 1 pt. of it at the ordinary temperature. (Brandes, cited by Mulder, in his *Silberprobirmethode*, p. 14.) No precipitate is formed when aqueous solutions of nitrate of lime and dilute sulphate of soda are mixed at the ordinary temperature, but on heating an abundant precipitate of sulphate of lime is formed. (Persoz, *Chim. Moléc.*, p. 382.) Soluble in an aqueous solution of acetate of soda. (Mulder, *loc. cit.*) More soluble in a solution of chloride of potassium than in water. (Mulder, *loc. cit.*, p. 16.)

Decomposed, with separation of carbonate of lime, when treated with aqueous solutions of the fixed alkaline carbonates. (Bergman, *Essays*, **1.** 223.) An equivalent of sulphate of lime is completely decomposed by an equivalent of an alkaline carbonate in aqueous solution. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 347.) Like sulphate of baryta, its precipitation is very much hindered by the presence of metaphosphate of soda. (Rube, *J. pr. Ch.*, 1858, **75.** 116.)

Insoluble in alcohol, the sp. gr. of which is 0.905, or less. (Anthon, *J. pr. Ch.*, **14.** 125.) Soluble in alcoholic solutions, — the alcohol being dilute, — of the nitrates of ammonia, potash, and soda, and the chlorides of ammonium, potassium, and sodium. (Marguerritte, *C. R.*, **38.** 308.)

1 equivalent of sulphate of lime is soluble in 3 equivalents of chlorhydric acid, — somewhat diluted, — at the ordinary temperature: on the addition of sulphuric acid to this solution a precipitate is produced. (Gladstone.) When sulphate of lime is treated with chlorhydric acid at the ordinary temperature it soon begins to be dissolved: in the solution thus obtained sulphuric acid produces a precipitate, but none is produced on the addition of a solution of chloride of calcium. If the acid and sulphate of lime are boiled together the latter is more completely dissolved, sulphuric acid producing a more abundant precipitate than before, but chloride of calcium still pro-

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* To obtain the solutions, sulphate of lime was mixed with an excess of the materials named, excepting the salts, of which only a single equivalent was employed in each case; the mixtures placed in small bottles which were nearly filled with water, and the whole shaken several times daily during a month. The temperature of the laboratory ranging meanwhile from 15° @ 20°. Portions were then filtered off into beaker-glasses, the weight of solution taken determined, and the lime precipitated as oxalate.

duces none. "Sulphate of lime is consequently much more difficultly soluble in dilute sulphuric than in chlorhydric acid; nevertheless a concentrated aqueous solution of sulphate of lime affords no precipitate or cloudiness when treated with sulphuric acid." (H. Rose, *Pogg. Ann.*, **95.** 109.) Sulphate of lime is not taken up by very concentrated chlorhydric acid to nearly the same extent as when the acid is dilute, hence a saturated solution of the salt in the latter is copiously precipitated by the addition of fuming chlorhydric acid as well as by that of water. (S. W. Johnson, *Am. J. Sci.*, (2.) **35.** 283.)

When anhydrous sulphate of lime is treated with concentrated sulphuric acid at a temperature of from 80° @ 100° it is converted into bisulphate, a portion of which dissolves in the excess of acid. (Berzelius, *Lehrb.*)

*Bi*Sulphate of Lime. $Ca O, H O, 2 S O_3$ Somewhat soluble in concentrated sulphuric acid at a temperature of 80° @ 100°, separating out again as the solution cools. Instantly decomposed by water. Also decomposes gradually when exposed to the air. (Berzelius, *Lehrb.*, **3.** 403.)

Sulphate of Lime, of Magnesia, & of Potash. $2 (Ca O, S O_3); Mg O, S O_3; K O, S O_3 + 2 Aq$ Occurs as the mineral *Polyhalite.* Slowly decomposed, with partial solution, by water.

Sulphate of Lime & of Potash. $Ca O, S O_3; K O, S O_3 + Aq$ Sparingly soluble in water. Easily soluble in dilute chlorhydric acid. (J. A. Phillips, *J. Ch. Soc.*, **3.** 352.)

Sulphate of Lime & of Soda.

I.) Occurs as the mineral *Glauberite.* $Ca O, S O_3; Na O, S O_3$ Decomposed, with partial solution, by a small quantity of water; completely soluble in much water.

II.) Is not decomposed by water, but is $3 (Ca O, S O_3); Na O, S O_3$ sparingly soluble in water. (Reithner.)

Sulphate of Lime & of Uranium. $Ca O, S O_3; Ur_2 O_3, S O_3 + 15 Aq$ Occurs as the mineral *Medjidite.* Insoluble in water, but dissolves readily in the smallest quantity of dilute chlorhydric acid. (Lawrence Smith, *Am. J. Sci.*, (2.) **5.** 336.)

Sulphate of Lithia. $Li O, S O_3 + Aq$ Very slightly hygroscopic. (Kremers.) Very soluble in water. Not perceptibly soluble to a greater extent in hot than in cold water. (Hermann.) 1 pt. of the anhydrous salt is soluble in 2.89 pts. of water at 18°; or 100 pts. of water at 18° dissolve 34.6 pts. of it. (Berzelius, *Lehrb.*, **3.** 269.) Less soluble in warm water than in water at the ordinary temperature. (Troost.) Soluble in 2.33 pts. of cold or hot water. (Wittstein's *Handw.*)

1 pt. of the anhydrous salt			
is soluble in	2.83 pts. of water at		0°
"	2.91	"	20°
"	3.06	"	45°
"	3.30	"	65°
"	3.42	"	100°

(Kremers, *Pogg. Ann.*, **95.** 469.)

The saturated aqueous solution boils at 105°. (Kremers, *Pogg. Ann.*, **99.** 43.) Sparingly soluble in alcohol. (Berzelius, *Lehrb.*) Very sparingly soluble in alcohol. (Wittstein's *Handw.*) Easily soluble in alcohol. (Hermann.)

II.) *bi.* Soluble in water.
Has no existence. (Troost.)

Sulphate of Lithia & of Potash.
$Li O, S O_3; 2 (K O, S O_3)$

Sulphate of Lobelin.

Sulphate of Lophin. $N_2 \left\{ \begin{matrix} C_{28} H_8'' \\ C_{14} H_6'' \\ H_2 \end{matrix} \right. . H O, S O_3$ Efflorescent. Soluble in water, with partial decomposition; it is even possible to remove nearly all the sulphuric acid by repeatedly crystallizing it from water. Also soluble in alcohol, with similar partial decomposition. Soluble in sulphuric acid. (Atkinson & Gœssmann, *Ann. Ch. u. Pharm.*, **97.** 290.) More soluble in alcohol than in water. (Laurent.)

Sulphate of LuteoCobalt. (*Sulphate of LuteoCobaltiaque.*) $6 N H_3 . Co_2 O_3, 3 S O_3 + 5 Aq$ Effloresces in dry air. Rather insoluble in cold, but freely soluble in hot water. The solution is not readily decomposed by boiling. (Gibbs & Genth, *Smithson. Contrib.*, vol. **9.** pp. 40–44, of the memoir.) Sparingly soluble in cold, more soluble in hot water. (Fremy, *Ann. Ch. et Phys.*, (3.) **35.** 283.)

Sulphate of Magnesia.

$x =$ *anhydrous.* $Mg O, S O_3$ Quickly deliquesces. Easily soluble in water. Soluble in 2.961 pts. of water at 15°. (Gerlach's determination. See his table of sp. grs., below.) 100 pts. of water at 0° dissolve 25.76 pts. of it. (Otto-Graham.)

As good as insoluble in absolute alcohol. Slightly soluble in dilute spirit. (Fresenius, *Quant.*, p. 129.) [See also under *e*.] 100 pts. of alcohol of from 0.872 to 0.900 sp. gr. dissolve 1 pt. of sulphate of magnesia; but alcohol of from 0.817 to 0.848 sp. gr. dissolves none of it. (Kirwan, *On Mineral Waters*, p. 274 [T.].)

$b = Mg O, S O_3 + Aq$

$c = Mg O, S O_3 + 2 Aq$

$d = Mg O, S O_3 + 6 Aq$ *Vid. inf.* p. 610, col. 2.

$e = Mg O, S O_3 + 7 Aq$ (*Epsom Salts.*) Efflorescent in warm air. Ignited sulphate of magnesia dissolves very slowly in water, but the crystals are rapidly soluble.

100 pts. of water at °C.	Dissolve pts. of the anhydrous salt $Mg O, S O_3$.	Dissolve pts. of the cryst. salt $Mg O, S O_3 + 7 Aq$.
14.58°	32.76	103.69
39.86°	45.05	178.34
49.08°	49.18	212.61
64.35°	56.75	295.13
97.03°	72.30	644.44

(Gay-Lussac, *Ann. Ch. et Phys.*, (2.) **11.** 311.)

The curve of the solubility of the crystallized salt is a straight line, of which the equation is $y = 0.47816\, x° + 25.76$. (Gay-Lussac, *loc. cit.*)

100 pts. of water at °C.	Dissolve pts. of the anhydrous salt. Gay-Lussac.	Tobler.
0°	25.8	24.7
10°	30.5	
20°	35.0	
25°		37.1
30°	39.8	
40°	45.2	47.0
50°	49.7	
55°		52.8
60°	55.9	
70°	60.4	
80°	65.1	
90°	70.3	

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

100 pts. of water at 0° dissolve 25.76 pts. of the anhydrous salt, and 0.47816 pts. for every degree, centigrade, above this. (Gay-Lussac, cited by Gmelin.) 100 pts. of water at 0° dissolve 28.067 pts. of the anhydrous salt. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 226.) 100 pts. of the saturated aqueous solution contain, at the boiling point (105.5°), 57.5 pts. of the dry salt; or 100 pts. of water at 105.5° dissolve 135.52 pts. of it; or 1 pt. of the dry salt is soluble in 0.7391 pts. of water at 105.5°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) The aqueous solution saturated at 17.5° is of 1.2932 sp. gr., it contains 55.57% of the crystallized salt ($Mg O, S O_3 + 7 Aq$); or 100 pts. of water dissolve 125.06 pts. of the crystallized, or 60 pts. of the anhydrous salt at 17.5°. (Karsten, *Berlin Abhandl.*, 1840, p. 101.) 1 pt. of the crystallized salt is soluble in 0.799 pt. of water at 18.75°, forming a liquor of 1.2932 sp. gr.

The solution saturated at 8° is of 1.267 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24.** 210.) 100 pts. of water at 0° dissolve 53.8 pts. of it, and at the ordinary temperature 125 pts. (Otto-Graham.) Soluble in 2 pts. of cold, and in less than 1 pt. of boiling water. Insoluble in alcohol. (Wittstein's *Handw.*) Soluble in 2 pts. of cold, and in 0.5 pt. of boiling water. (Fourcroy.) Soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201; in *Canstatt's Jahresbericht, für* 1854, p. 76.) Soluble in 4 pts. of water at 0°, in 3 pts. at 15°, and in 1.4 pts. at 97°. (Schubarth's *Tech.*)

1 pt. of the anhydrous salt is soluble in pts. of water.	1 pt. of the crystallized salt is soluble in pts. of water.	at °C.	100 pts. of the saturated solution contain pts. Of the anhydrous salt.	Of the crystallized salt.
3.05	0.96	14.4	24.67	50.90
1.38	0.155	97.2	41.96	86.56

(M. R. & P.)

The aqueous solution saturated at

10°	contains 33.3%	of the salt	(Eller);
in the cold	" 33.3%	"	(Fourcroy);
at 38° (of B.'s therm.)	" 43.6%	"	(Bœrhave);
at 12.5°	" 53.3%	"	(Hassenfratz, *Ann. de Chim.*, **28.** 291.)

100 pts. of water at 15.5° dissolve 100 pts. of the crystallized salt, and at 100°, 130 @ 150 pts. (Ure's *Dict.*) The aqueous solution saturated at 15° is of 1.275211 sp. gr., and contains dissolved n every 100 pts. of water at least 92.217 pts. of the crystallized salt. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) Soluble in 1 pt. of water at a moderate heat, and in scarce 0.66 pt. of boiling water. Insoluble in rectified spirit. (Bergman, *Essays*, **1.** pp. 181, 438, 457.)

1 pt. of the 7 Aq salt is soluble in 0.933 pts. of water at 15° (Gerlach's determination, see his table of sp. grs., below); in 0.92 pt. of water at 23°; or 100 pts. of water at 23° dissolve 108.3 pts. of it; or the aqueous solution saturated at 23° contains 52% of it, or 24.4% of the anhydrous salt, and is of 1.2863 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.)

Boiling aqueous solutions of sulphate of magnesia, which are not too highly charged with the salt, do not crystallize when they are cooled in closed vessels out of contact with atmospheric air [or in vessels loosely stopped with pledgets of cotton-wool, by which the air is filtered (Schrœder, *Ann. Ch. u. Pharm.*, **109.** 45)], phenomena of supersaturation like those exhibited by sulphate and carbonate of soda being manifested. This behavior is owing to the formation of a six-hydrated salt, which is much more soluble in water than the seven-hydrated salt, and also to the formation of an isomeric modification (β) of the seven-hydrated salt, crystallizing in tables, which is less soluble than the six-hydrated salt, but more soluble than the ordinary (α) seven-hydrated needles. Thus, the saturated aqueous solution of the six-hydrated salt ($Mg O, S O_3 + 6 Aq$) [mother liquor, from which crystals have been deposited] contains at

0°, 40.75 pts. of anhydrous $Mg O, S O_3$ in 100 pts. of water.
10°, 42.23 " " "
20°, 43.87 " " "

while the mother liquor, from which crystals of the tabular seven-hydrated salt ($Mg O, S O_3 + 7 Aq$ (β)) had separated, contains at

0°, 34.67 pts. of anhydrous $Mg O, S O_3$ in 100 pts. of water.
10°, 38.71 " " "
20°, 42.84 " " "

This salt ($Mg O, S O_3 + 7 Aq$ (β)) does not crystallize at temperatures above 21° @ 22°. At 25° @ 30° crystals of the six-hydrated salt are formed. (Lœwel, *Ann. Ch. et Phys.*, (3.) **43.** 405; compare Schrœder, *Ann. Ch. u. Pharm.*, **109.** 51.)

The relations appear to better advantage in the following table.

At °C.	A saturated aqueous solution of $Mg O, S O_3 + 7 Aq$ (α) contains		A saturated aqueous solution of $Mg O, S O_3 + 7 Aq$(β) contains		A saturated aqueous solution of $Mg O, S O_3 + 6 Aq$ contains		
	Anhydrous $Mg O, S O_3$ dissolved by 100 pts. of water.	7 Aq(α) salt dissolved by 100 pts. of water.	Anhydrous $Mg O, S O_3$ dissolved by 100 pts. of water.	7 Aq (β) salt dissolved by 100 pts. of water.	Anhydrous $Mg O, S O_3$ dissolved by 100 pts. of water.	6 Aq salt dissolved by 100 pts. of water.	7 Aq salt dissolved by 100 pts. of water.
0°	26.0	73.31	34.67	111.74	40.75	122.22	146.02
10°	30.9	93.75	38.71	133.67	42.23	129.44	155.53
20°	35.6	116.54	42.84	159.61	43.87	137.72	167.97

(Lœwel, *loc. cit.*, p. 413.)

Percentage of Sulphate of Magnesia in aqueous Solutions of known Specific Gravity.

Sp. gr. (at 15°).	Percent of $Mg O, S O_3 + 7 Aq$.
1.006	0.99
1.010	1.96
1.016	2.91
1.020	3.84
1.024	4.76
1.029	5.66
1.034	6.54
1.039	7.41
1.043	8.25
1.046	9.09
1.050	9.91
1.055	10.71
1.059	11.50
1.064	12.28
1.068	13.04
1.072	13.79
1.075	14.52
1.080	15.25

Sp. gr. (at 15°).	Percent of Mg O, S O_3 + 7 Aq.
1.084	15.96
1.088	16.66
1.091	17.35
1.095	18.03
1.098	18.69
1.101	19.35
1.104	20.00
1.107	20.63
1.111	21.26
1.114	21.87
1.117	22.48
1.120	23.07
1.124	23.66
1.128	24.24
1.131	24.81
1.134	25.37
1.137	25.92
1.140	26.47
1.143	27.01
1.145	27.53
1.147	28.05
1.150	28.57
1.153	29.07
1.155	29.57
1.158	30.06
1.161	30.55
1.164	31.03
1.166	31.51
1.168	31.97
1.170	32.43
1.172	32.88
1.174	33.33
1.207	37.50
1.230	41.17
1.250	44.44
1.270	47.36
1.282 (at 27.5°)	50.00
1.294 (at 32.5°)	52.38
1.304 (at 37.5°)	54.54

(Anthon, *J. pr. Ch.*, **7.** 71; **9.** 3; and *Gmelin's Handbook*, **3.** 239.)

From Anthon's table, Schiff calculates the following table for the anhydrous salt, by means of the formula: $D = 1 + 0.011\,p - 0{,}00003\,p^2 + 0.00000084\,p^3$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 15°).	Percent of anhydr. Mg O, S O_3.	Sp. gr. (at 15°).	Percent of anhydr. Mg O, S O_3.
1.054	5	1.326	30
1.108	10	1.384	35
1.161	15	1.446	40
1.215	20	1.511	45
1.269	25	1.580	50

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **107.** 303.)

Sp. gr. (at 15°).	Percent of Mg O, S O_3.	Percent of Mg O, S O_3 + 7 Aq.
1.01031	1	2.049
1.02062	2	4.097
1.03092	3	6.146
1.04123	4	8.195
1.05154	5	10.244
1.06229	6	12.292
1.07304	7	14.341
1.08379	8	16.390
1.09454	9	18.439
1.10529	10	20.487
1.11668	11	22.536
1.12806	12	24.585
1.13945	13	26.634
1.15083	14	28.682
1.16222	15	30.731
1.17420	16	32.780
1.18618	17	34.828
1.19816	18	36.877
1.21014	19	38.926
1.22212	20	40.975
1.23465	21	43.023
1.24718	22	45.072
1.25972	23	47.121
1.27225	24	49.170
1.28478	25	51.218
1.28802	25.248	51.726 *

(* Saturated solution.)

(Gerlach, *Sp Gew. der Salzlœsungen*, p. 22.) See also a table of the sp. gr. of a 20% solution for each degree of temperature from 0° to 50°, on p. 124 of Gerlach's work.

An aqueous solution of sp. gr. (at 23°).	Contains (by experiment) percent of Mg O, S O_3 + 7 Aq.
1.2863	52.23
1.1806	34.82
1.1162	23.21
1.0862	17.36
1.0569	11.60
1.0273	5.80

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 336.)

From these results Schiff calculates the following table by means of the formula: $D = 1 + 0.004776\,p + 0.00000846\,p^2 + 0.000000098\,p^8$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 23°).	Percent of Mg O, S O_3 + 7 Aq.	Percent of anhydr. Mg O, S O_3.
1.0048	1	0.488
1.0096	2	0.975
1.0144	3	1.463
1.0193	4	1.951
1.0242	5	2.439
1.0290	6	2.928
1.0339	7	3.416
1.0387	8	3.904
1.0437	9	4.392
1.0487	10	4.878
1.0537	11	5.366
1.0587	12	5.854
1.0637	13	6.342
1.0688	14	6.830
1.0739	15	7.318
1.0790	16	7.806
1.0842	17	8.294
1.0894	18	8.782
1.0945	19	9.270
1.0997	20	9.756
1.1050	21	10.244
1.1103	22	10.732
1.1156	23	11.220
1.1209	24	11.708
1.1262	25	12.196
1.1316	26	12.684
1.1371	27	13.172
1.1426	28	13.660
1.1481	29	14.148
1.1536	30	14.634
1.1592	31	15.122
1.1648	32	15.610
1.1704	33	16.098
1.1760	34	16.586
1.1817	35	17.074
1.1875	36	17.562
1.1933	37	18.050
1.1991	38	18.538
1.2049	39	19.026
1.2108	40	19.512

Sp. gr. (at 23°).	Percent of $Mg O, S O_3 + 7 Aq$.	Percent of anhydr. $Mg O, S O_3$.
1.2168	41	20.000
1.2228	42	20.488
1.2288	43	20.976
1.2349	44	21.464
1.2410	45	21.952
1.2472	46	22.440
1.2534	47	22.928
1.2596	48	23.416
1.2659	49	23.904
1.2722	50	24.390
1.2786	51	24.878
1.2850	52	25.366
1.2915	53	25.854
1.2980	54	26.341

(H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 185.)

A solution of sp. gr. at 12.5°.	Contains percent of sulphate of magnesia.
1.0096	2
1.0192	4
1.0286	6
1.0379	8
1.0470	10
1.0555	12
1.0646	14
1.0711	16
1.0771	18
1.0860	20
1.0976	22
1.1092	24
1.1178	26
1.1324	28
1.1440	30
1.1557	32
1.1675	34
1.1789	36
1.1905	38
1.2122	40
1.2262	42
1.2302	44
1.2432	46
1.2562	48
1.2683	50
1.2833	52
1.2973	54

(Hassenfratz, *Ann. de Chim.*, **28.** 297.)

Sp. gr.	Percent of $Mg O, S O_3$.
1.50	44.4
1.42	39
1.30	30

The solution of 1.50 sp. gr. is the strongest liquid obtainable by boiling; that of 1.30 sp. gr. is the saturated solution at 15.56°. (Dalton, in his *New System*, Pt. **2.** 517.)

Insoluble in alcohol; tolerably soluble in spirit.

Sp. gr.	A solution (saturated at 15°) in alcohol of Percent by weight.	Contains percent of $Mg O, S O_3 + 7 Aq$.
1.000	0	50.8
0.986	10	39.3
0.972	20	21.3
0.939	40	1.62

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.)

Sulphate of magnesia may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.) Much more readily soluble in chlorhydric acid than in water, and this without decomposition. (Richter.)

Soluble in saturated aqueous solutions of sulphate of soda (*vid. inf.*), and of sulphate of potash (*vid. inf.*). (Karsten.) When an excess of a mixture of sulphate of magnesia and sulphate of soda is treated with water, 100 pts. of the latter at 0° dissolve 28.392 pts. of the mixed salts, viz. 15.306 pts. of $Mg O, S O_3$, and 13.086 pts. of $Na O, S O_3$. When an excess of water is employed, other relations than these must, of course, obtain. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 226.)

Rapidly soluble in a saturated solution of sulphate of copper: when this has become saturated with it, crystals of a double salt separate out; and if one contiuues to add sulphate of magnesia, nearly all the sulphate of copper may thus be removed from the solution. (Karsten, *Berlin Abhandl.*, 1840, p. 125.) Slowly soluble in a saturated solution of sulphate of zinc without occasioning any precipitation, until the solution has become saturated with it, when crystals of a double salt separate out. (Karsten, *loc. cit.*) Soluble in a saturated solution of chloride of sodium, without any precipitation of the latter. (Karsten, *loc. cit.*, p. 115.) Rapidly soluble in considerable quantity in a saturated solution of chloride of potassium, sulphate of potash separating out meanwhile. (Karsten, *loc. cit.*, p. 130.) Somewhat soluble in a saturated solution of chloride of ammonium, with separation of a double sulphate of ammonia and magnesia. (Karsten, *loc. cit.*, p. 123.) Readily soluble in a saturated solution of nitrate of potash without causing any precipitation. (Karsten, *loc. cit.*, p. 124.)

When one equivalent of $Mg O, S O_3$, in aqueous solution, is mixed with a solution of an equivalent of chloride of potassium ($K Cl$) $\frac{56}{100}$ of it are decomposed to sulphate of potash, which may be precipitated by adding alcohol, while $\frac{44}{100}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of sodium ($Na Cl$), $\frac{545}{1000}$ of it are decomposed as before, while $\frac{455}{1000}$ of it remain unchanged. (Malaguti, *Ann. Ch. et Phys.*, 1853, (3.) **37.** 203.)

Soluble in a saturated solution of nitrate of soda, without causing any precipitation of the latter. The sp. gr. of the solution thus obtained is the same as that of a solution prepared at the same temperature, by treating a mixture of the two salts with water. (Karsten, *loc. cit.*, p. 115.)

SULPHATE OF MAGNESIA & OF MANGANESE. $Mg O, S O_3;\ Mn O, S O_3 + 2 Aq$ Permanent. Soluble in water; if the solution is allowed to evaporate spontaneously the component salts always crystallize apart, the double salt being entirely decomposed; but if the solution — or any mixed solution of $Mg O, S O_3$ and $Mn O, S O_3$ — be evaporated at a temperature above 38° the double salt crystallizes out as such. (Arrott, *Phil. Mag.*, 1844, (3.) **24.** 502.)

SULPHATE OF MAGNESIA, OF MANGANESE, & OF POTASH. $Mg O, S O_3;\ Mn O, S O_3;\ 2 (K O, S O_3) + 12 Aq$

SULPHATE OF MAGNESIA, OF MANGANESE, & OF ZINC. $Mg O, S O_3;\ Mn O, S O_3;\ Zn O, S O_3 + (?) Aq$

SULPHATE OF MAGNESIA, OF NICKEL, & OF POTASH. $Mg O, S O_3;\ Ni O, S O_3;\ 2 (K O, S O_3) + 12 Aq$

SULPHATE OF MAGNESIA & OF POTASH. $Mg O, S O_3;\ K O, S O_3 + 6 Aq$ Permanent. This compound does not separate either from a solution of sulphate of potash in a saturated aqueous solution of sulphate of magnesia, or from a solution of sulphate of magnesia in a saturated solution of sulphate of potash, until these are slowly evaporated. (Karsten, *Berlin Abhandl.*, 1840, p. 121.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
0°	14.1
10°	19.6
20°	25.0
30°	30.4
35°	33.2
45°	40.5
55°	47.0
60°	50.2
65°	53.0
75°	59.8

(Tobler, *Ann. Ch. u. Pharm.*, **95**. 198, and fig.)

1 pt. of the 6 Aq salt is soluble in 3.7 pts. of water at 15°; or 100 pts. of water at 15° dissolve 27 pts. of it; or an aqueous solution saturated at 15° contains 21.1% of it, or 15.4% of the anhydrous salt, and is of 1.1467 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113**. 350.)

An aqueous solution of sp. gr. (at 15°).	Contains (by experiment) percent of Mg O, S O_3; K O, S O_3 + 6 Aq.
1.0150	2.35
1.0303	4.69
1.0464	7.03
1.0620	9.38
1.0954	14.06
1.1467	21.09

From these results Schiff deduces the formula: $D = 1 + 0.006415\,p + 0.00002632\,p^2$, in which D = the sp. gr. of the solution, and p the percentage of substance contained in it, by means of which Ott has calculated the following table.

Sp. gr. (at 15°).	Percent of Mg O, S O_3; K O, S O_3 + 6 Aq.	Percent of anhydr. Mg O, S O_3; K O, S O_3.
1.0064	1	0.732
1.0129	2	0.463
1.0195	3	2.195
1.0261	4	2.926
1.0327	5	3.658
1.0394	6	4.390
1.0462	7	5.121
1.0530	8	5.853
1.0599	9	6.584
1.0668	10	7.316
1.0737	11	8.048
1.0808	12	8.779
1.0878	13	9.511
1.0950	14	10.242
1.1021	15	10.974
1.1094	16	11.706
1.1167	17	12.437
1.1240	18	13.169
1.1314	19	13.900
1.1388	20	14.632
1.1463	21	15.364
1.1539	22	16.095

(H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113**. 198.)

SULPHATE OF MAGNESIA, OF POTASH, & OF ZINC.
Mg O, S O_3; 2 (K O, S O_3); Zn O, S O_3 + 12 Aq

SULPHATE OF MAGNESIA & OF SODA.

I.) *anhydrous.*
Mg O, S O_3; Na O, S O_3

II.) *hydrated.* Permanent. The 6 Aq salt is soluble in about 3 pts. of water at 15.5°. (Murray, *Edinburgh Trans.*, **8**. 233 [T.].) Soluble in water; if the solution is allowed to evaporate spontaneously the component salts always crystallize apart, the double salt being entirely decomposed, but if the solution, — or any mixed solution of Mg O, S O_3, and Na O, S O_3, — is evaporated at a temperature above 38° the salt Mg O, S O_3; Na O, S O_3 + 4 Aq crystallizes out. (Arrot, *Phil. Mag.*, 1844, (3.) **24**. 502.)
Mg O, S O_3; Na O, S O_3 + 4 Aq & 6 Aq

SULPHATE OF MAGNESIA & OF ZINC. Soluble in water. (Karsten.) Permanent. If the aqueous solution is allowed to evaporate spontaneously, the component salts always crystallize apart, the double salt being entirely decomposed, but if the solution, — or any mixed solution of Mg O, S O_3 and Zn O, S O_3, — is evaporated at a temperature above 38° the salt Mg O, S O_3; Zn O, S O_3 + 4 Aq crystallizes out. (Arrott, *Phil. Mag.*, 1844, (3.) **24**. 502.)
Mg O, S O_3; Zn O, S O_3 + 4 Aq & 10 Aq & 14 Aq

SULPHATE OF MANGAN*bi*AMIN.
(*AmmonioSulphate of Manganese.*)
$\left.N_2\right\} H_6 \,.\, \mathrm{Mn\,O, S\,O_3}$

SULPHATE *of protoxide* OF MANGANESE.

a = *anhydrous.* Absorbs water from the air to form the terhydrate (*d*).
Mn O, S O_3

1 pt. of the anhydrous salt is

soluble in	1.770	pts. of water at	6.25° C.
“	1.631	“	10°
“	1.667	“	18.75°
“	1.457	“	37.5°
“	1.494	“	75°
I. = 1.941 II. = 2.121	mean = 2.031	“	101.25°

Or

100 pts. of water at	6.25°	dissolve	56.49	pts. of it.
“	10°	“	61.29	“
“	18.75°	“	60.00	“
“	37.5°	“	68.63	“
“	75°	“	66.95	“
	101.25° I. = 47.143 II. = 51.515	mean	49.33	“

Or the aqueous solution

saturated at	6.25°	contains	36.1%	of it.
“	10°	“	38	“
“	18.75°	“	37.5	“
“	37.5°	“	40.7	“
“	75°	“	40.1	“
	101.25° I. = 32.04 II. = 34.00	mean =	33.02%	of it.

(Brandes, *Pogg. Ann.*, 1830, **20**. pp. 575 – 581.)
[See also under *e.*]

The anhydrous, ignited salt is soluble in 2.5 pts. of water at 18.75°; at first it combines with the water with great avidity, and hardens like burnt gypsum, and is then dissolved with difficulty at the ordinary temperature, unless the mass is powdered. At 62.5° it is difficult to dissolve 1 pt. of it in 3 pts. of water. The assertion that the clear solution saturated at 62.5° becomes cloudy on being heated, and clears up again when allowed to cool, was not corroborated; on the other hand, it was found that the higher the temperature so much the more of the salt was dissolved. (Fr. Jahn, *Ann. der Pharm.*, 1838, **28**. 110.) *Vid. inf.*

Insoluble in absolute alcohol; but soluble to a slight extent in weak spirit. A quantity of the 7 Aq (*g*) salt having been boiled with alcohol of 55%, “50° grains of the hot decanted fluid were evaporated, and left 1 grain of anhydrous salt. Dilute spirit consequently takes up some of the salt, but only an insignificant quantity, hardly 0.2 percent.” (Brandes, *loc. cit.*, p. 588.) [The manifest disagreement between the figures in the preceding paragraph seems at first sight to be explained by the degree mark after the 50 having been placed instead of a large 0, but Schiff (*Ann. Ch. u. Pharm.*, 1861, **118.** 366), having found, by experiment, that a saturated solution, in alcohol of 50%, contains 2% of the 4 Aq salt, asserts that Brandes really meant to print 50, and not 500, in the paragraph above cited.] For Schiff's results see the 4 Aq salt (*e*). Insoluble in spirit of 0.83 @ 0.85. 1000 pts. of spirit of 0.872 dissolve 6.3 pts. of it; and 1000 pts. of spirit of 0.905 dissolve about 11 pts. of it. (Anthon, from *Buchner's Repert.*, **2.** pp. 13, 18; in *J. pr. Ch.*, **14.** 125.) Insoluble in absolute ether, or in boiling oil of turpentine. (Brandes.)

$b = \mathrm{Mn\,O, S\,O_3 + Aq}$ Separates out when a concentrated aqueous solution of *e* is treated with sulphuric acid. (Kuehn.) Is precipitated when a solution of sulphate of manganese with excess of acid is rapidly boiled. (Kuehn & Ohlmann, *Schweigger's J. für Phys. u. Ch.*, **61.** 239 [*Gm.*].) Also on boiling a neutral solution. (Graham.)

$c = \mathrm{Mn\,O, S\,O_3 + 2\,Aq}$ Separates out on melting the 7 Aq salt in its water of crystallization, and on heating it to 81° with spirit of 55%. (Brandes, *Pogg. Ann.*, 1830, **20.** pp. 583, 586.)

$d = \mathrm{Mn\,O, S\,O_3 + 3\,Aq}$ Found at the bottoms of the vessels in which the 4 Aq salt has crystallized, also mixed with the crystals of the latter. May also be prepared by exposing the anhydrous salt to the air, and by removing 1 Aq from the 4 Aq salt by boiling alcohol, &c., &c. (Brandes.)

$d = \mathrm{Mn\,O, S\,O_3 + 3\,Aq}$ Rather difficultly soluble in water [T.]. Brandes remarks that he cannot agree with Thomson in considering it as “difficultly soluble,” and that T.'s statement is improbable, since when this hydrate is treated with a sufficient amount of water it is soon converted into the 4-hydrated salt, which is very readily soluble. (Brandes, *Pogg. Ann.*, 1830, **20.** 567.)

$e = \mathrm{Mn\,O, S\,O_3 + 4\,Aq}$ (*Common Sulphate of Manganese.*) Permanent. Crystallizes out at ordinary temperatures. This hydrate is present in the aqueous solution at temperatures between 20° and 30°. (Mitscherlich.) Less soluble in boiling than in cold water. (Brandes.) 100 pts. of water at 4.4° dissolve 31 pts. of the salt previously dried at 65.5°. Insoluble in alcohol. (John, *Ann. Phil.*, **2.** 103 [T.].)

Soluble in	0.833 *pts.	of water at	6.25°
“	0.790	“	10°
“	0.820	“	18·75°
“	0.670	“	37.50°
“	0.690	“	75°
“	1.070	“	101.25°

Or

100 pts. of water at	6.25°	dissolve	113.22	pts. of it.
“	10°	“	123	“
“	18.75°	“	122	“
“	37.50°	“	149	“
“	75°	“	144	“
“	101.25°	“	93	“

Or the aqueous solution

saturated at	6.25°	contains	53.1%	of it.
“	10°	“	56	“
“	18.75°	“	55	“
“	37.50°	“	59.9	“
“	75°	“	59	“
“	101.25°	“	48.4	“

(Brandes, *Pogg. Ann.*, 1830, **20.** pp. 575 – 581.)

In the same connection Brandes insists that the statements of previous observers are incorrect, and that the figures given in the text-books of his time, indicating that 1 pt. of this salt requires 2.5 pts. of cold water for its solution must be erroneous. It is, however, very probable that some of B.'s solutions were supersaturated. See below.

The salt does not melt in its water of crystallization. A solution saturated at 6.25° being heated, while new portions of the salt were gradually added, remained clear until the temperature had risen to 92.5°. When it began to lose its transparence, at 93.75°, a crust of salt formed on top, and the whole of the liquid became cloudy, at 97.5° the bottom of the dish was covered with a crust of salt, and at 100° the entire liquid was thick, cloudy, and gelatinous. At 102.1° the constant boiling point was attained. On now allowing this liquid to cool it gradually became clearer and clearer, the crusts of salt disappeared, and when the temperature had fallen to 21.25° the salt had entirely redissolved. On heating to boiling a clear solution saturated at 6.25°, in such a manner that little or no water could be lost by evaporation, it became cloudy, and finally quite white and opaque, but on allowing it to cool it gradually became again perfectly clear; on trial it was found that 1% of the salt crystallized out on boiling for a few minutes, and a larger quantity when the ebullition was longer continued. The salt thus separated still contains 4 equivs. of Aq. (Brandes, *loc. cit.*) When the solution saturated at 50° is heated, a portion of the salt is deposited, but on cooling to 50° this precipitate redissolves. (Berzelius's *Lehrb.*) A portion of the 4 Aq salt having been left in contact with water during several days, and frequently agitated, contained of the anhydrous salt at 6.25° C., 31.85 pts.,* i. e. 1 pt. of the salt (calculated as anhydrous) dissolves in 2.14 pts. of water at 6.25°; or 100 pts. of water at 6.25° dissolve 46.74 pts. of it. On cooling to 6.25° a boiling saturated aqueous solution of the salt, it was found that the solution then contained 35.07% of the anhydrous salt, i. e. 1 pt. of the anhydrous salt remains dissolved in 1.852 pts. of water at 6.25°; or 100 pts. of water at 6.25° dissolve 54.00 pts. of it. In a repetition of the last experiment 36.1% of the anhydrous salt were found in the solution at 6.25°; and the author “takes this experiment as the more accurate, since in it the largest quantity of salt was dissolved.” This number 36.1 does not agree with the other figures of the determination, but the error appears to be purely typographical: from it Brandes deduces the solubility of the 4-hydrated salt (for temperature 6.25°) as given above. Compare foot-note on page 614.

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* See below, for method of determining the solubility in this case. As a control, another experiment was made at 6.25°, in which known portions of the 4 Aq salt were added, finally a grain at a time, to a determined quantity of water, until no more could be dissolved, even after standing a week The solution thus obtained contained 55 percent of the 4 Aq salt. The author considers the results given in the text as the most reliable.

* In another experiment, made for the purpose of controlling this, Brandes gives the percentage of anhydrous salt as “33.1,” but this does not agree with the other figures of his determination, which indicate 35.71 percent of the anhydrous salt. F. H S

Insoluble in absolute alcohol. At 12.5° absolute alcohol does not remove any of its water of crystallization, but abstracts one equivalent of it at the temperature of boiling. (Brandes, *loc. cit.*, p. 573.)

A solution (saturated at 15°) in alcohol of Sp. gr.	Percent by weight.	Contains percent of $MnO, SO_3 + 4$ Aq.
1.000	0	56.25
0.986	10	51.40
0.917	50	2.00
0.895	60	0.66

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.)

When the salt is dissolved at the ordinary temperature in alcohol of from 10 to 50% a curious phenomenon occurs as soon as the solution has become saturated; two layers of liquid being formed, the lower containing less alcohol and more salt than the upper, which contains but little of the salt. By direct experiment it was found that this separation did not occur when alcohol of less than 15%, or more than 50% was employed, at the ordinary temperature. On heating, a similar separation occured in solutions in alcohol of 13, 14, and 60%, but on solutions in alcohol of 10 @ 12% warming had no influence. [For the details of experiments on this point, see Schiff's memoir, *loc. cit.*, p. 370.]

Insoluble in absolute ether, and this does not remove any of its water of crystallization, at least at the ordinary temperature. (Brandes, *loc. cit.*) Insoluble in boiling oil of turpentine, but this removes one equivalent of its water. (Brandes, *loc. cit.*, p. 574.)

$f = MnO, SO_3 + 5$ Aq Crystallizes from solutions evaporated at temperatures between 7° and 20°. (Regnault, *Ann. Ch. et Phys.*, **76.** 200 [*Gm.*].) Soluble in water. Insoluble in absolute alcohol. (Brandes, *Pogg. Ann.*, 1830, **20.** 583.) The 5 Aq salt is soluble in 1 pt. of water at 18.75°. (Fr. Jahn, *Ann. der Pharm.*, 1838, **28.** 110.)

$g = MnO, SO_3 + 7$ Aq Crystallizes from solutions evaporated at temperatures between —4° and +5°. Efflorescent. Melts very quickly in its water of crystallization, becoming soft at 12.5°, and softer as the temperature rises, being tolerably fluid at 38°, though at no time can a complete solution be thus obtained, the same opaque, sirupy condition existing at 75°, and even on boiling. This behavior appears to depend upon the separation of the bihydrate, which remains disseminated in the melted quinthydrate. When heated with absolute alcohol it becomes soft at 15°, but no more so than if it were heated by itself to this temperature, and gives up some of its water, so that at 18.75° it becomes hard again, and at 25° has become completely converted into the 4 Aq salt. On boiling with absolute alcohol still more water is removed, and the 3 Aq salt formed, but none of the salt itself is dissolved by absolute alcohol. On heating another portion of the salt in alcohol of 55% it became soft at 11.25°, fell to a fine crystalline meal at 12.5°, soft at 15°, a portion becoming tolerably fluid at 17.5°, and more fluid as the temperature was elevated, being tolerably limpid at 37.5°, and still more so up to 75°, when the mass again began to become sirupy and suddenly solidified at 81.25°, from separation of the 2 Aq salt. On boiling the salt with spirit of 55%, and examining the decanted solution, it was found to contain 0.2% of the anhydrous salt, hence 1 pt. of anhydrous MnO, SO_3 is soluble in 499 pts. of boiling alcohol of 0.55%. Insoluble in absolute ether at temperatures between 5° and 7°, and none of its water is removed by the ether. (Brandes, *Pogg. Ann.*, 1830, **20.** pp. 568, 582, 584 – 588.)

The 7 Aq salt requires hardly 0.5 pt. of water to dissolve it at 18.75°. (Fr. Jahn, *Ann. der Pharm.*, 1838, **28.** 110.) Sulphate of manganese may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

When one equivalent of MnO, SO_3, in aqueous solution, is mixed with a solution of an equivalent of chloride of potassium (KCl) $\frac{58}{100}$ of it are decomposed to sulphate of potash, which may be precipitated by adding alcohol, while $\frac{42}{100}$ of it remain unchanged. (Malaguti, *Ann. Ch. et Phys.*, 1853, (3.) **37.** 203.)

SULPHATE *of sesquioxide* OF MANGANESE. $Mn_2O_3, 3SO_3$ Exceedingly hygroscopic. Decomposed by water with evolution of heat, also by dilute acids, by spirit at once, and by absolute alcohol after a time. As good as insoluble in concentrated sulphuric acid; and is not acted upon by it at temperatures lower than that of ebullition, but when boiled with strong sulphuric acid it is gradually decomposed. Soluble in concentrated chlorhydric acid, with evolution of chlorine when the solution is heated. Insoluble in concentrated nitric acid, which has no action upon it at temperatures below 100°. (Carius, *Ann. Ch. u. Pharm.*, **98.** 64.)

SULPHATE *of protoxide* OF MANGANESE, OF NICKEL, & OF POTASH. $MnO, SO_3; NiO, SO_3; 2(KO, SO_3) + 12$ Aq

SULPHATE *of protoxide* OF MANGANESE & OF POTASH. $MnO, SO_3; KO, SO_3 + 4$ Aq Permanent. Tolerably soluble in cold, much more soluble in boiling water. (Pierre, *Ann. Ch. et Phys.*, (3.) **16.** 254.)

SULPHATE *of sesquioxide* OF MANGANESE & OF POTASH. (*Potash Manganese Alum.*) $Mn_2O_3, 3SO_3; KO, SO_3 + 24$ Aq Soluble, with decomposition, in water. (Mitscherlich.)

SULPHATE *of protoxide* OF MANGANESE, OF POTASH, & OF ZINC. $MnO, SO_3; 2(KO, SO_3); ZnO, SO_3 + 12$ Aq

SULPHATE *of protoxide* OF MANGANESE & OF SODA.

I.) $MnO, SO_3; NaO, SO_3 + 2$ Aq Permanent. More soluble in water than the 6-hydrated salt (No. 2). The aqueous solution is not decomposed at 100°, and on evaporating it at 55° the double salt crystallizes out as such, but when the solution is allowed to evaporate spontaneously the component salts crystallize out separately. (Arrott.)

II.) $MnO, SO_3; NaO, SO_3 + 6$ Aq Deliquesces in moist, but effloresces in warm air. Soluble in 1.2 pts. of boiling water. (Geiger.)

SULPHATE OF MELAMIN. Sparingly soluble in cold, much more soluble in warm water.

SULPHATE OF MELANILIN. $N_2\left\{\begin{matrix}C_{12}H_4(C_2N)\\C_{12}H_5\\H_4\end{matrix}\right. . HO, SO_3$ Somewhat difficultly soluble in cold, much more easily soluble in boiling water. Soluble in alcohol, and ether. (Hofmann, *J. Ch. Soc.*, **1.** 291.)

SULPHATE OF MENAPHTHALAMIN. Tolerably soluble in alcohol, and ether.

SULPHATE OF MENISPERMIN.

SULPHATE OF MERCUR(*ic*)-AMMONIUM.
$N\left\{\begin{matrix}H_3\\Hg\end{matrix}\right. . O, SO_3$

SULPHATE OF MERCUR(*ic*)-AMMONIUM with *protoxide* OF MERCURY.

I.) $N\left\{\begin{matrix}H_3\\Hg\end{matrix}\right. O, SO_3 ; HgO$

II.) $N\left\{\begin{matrix}H_3\\Hg\end{matrix}\right. O, SO_3 ; 2HgO$

III.) $N\left\{\begin{matrix}H_2\\2Hg\end{matrix}\right. O, SO_3 ; 2HgO$

All these bodies are decomposed by water. (Millon, *Ann. Ch. et Phys.*, (3.) **18.** 402.) The last is only very slightly soluble in water; but soluble in chlorhydric, and nitric acids. (Kane.)

SULPHATE OF *di*MERCUR(*ous*)AMMONIUM.
$N\left\{\begin{matrix}H_2\\2Hg_2\end{matrix}\right. . O, SO_3$

SULPHATE OF *di*MERCUR(*ous*)AMMONIUM with *dinOxide of* MERCURY.
$N\left\{\begin{matrix}H_2\\2Hg_2\end{matrix}\right. . O, SO_3 ; 2Hg_2O$

SULPHATE OF MERCUR(*ous*)ETHYL. (*Sulphate of HydrargEthyl.*) $C_4H_5Hg_2O, SO_3$ Soluble in alcohol. (Duenhaupt.)

SULPHATE *of dinoxide* OF MERCURY. Hg_2O, SO_3 Very sparingly soluble in cold, decomposed by boiling water, with formation of an insoluble basic and a soluble acid salt of the protoxide. (H. Rose.) Soluble in 500 pts. of cold, and in 300 pts. of boiling water. Easily soluble in hot, less soluble in cold dilute sulphuric acid. (Berzelius's *Lehrb.*) Only soluble to an insignificant extent in free acids. Its best solvents are dilute sulphuric acid and aqueous solutions of the sulphates of potash and soda. (H. Rose, *Tr.*) Soluble in dilute nitric acid, from which solution it may be almost entirely precipitated on the addition of dilute sulphuric acid. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 319.) Somewhat more soluble in boiling than in cold weak nitric acid. (Stædeler, *Ann. Ch. u. Pharm.*, **87.** 133.) Abundantly soluble in hot concentrated sulphuric acid.

When treated with aqueous solutions of the alkaline chlorides, and especially if these are hot, a certain amount of bichloride of mercury forms and is dissolved. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 179.)

SULPHATE *of protoxide* OF MERCURY.

I.) *mono.* HgO, SO_3 Decomposed by water, even in the cold, but more quickly when this is warm, to the trisulphate ($3HgO, SO_3$) and free sulphuric acid containing a little protoxide of mercury in solution. No acid salt is formed. (H. Rose, *Pogg. Ann.*, **83.** 141.) Soluble, with decomposition to protochloride of mercury, in an aqueous solution of chloride of sodium. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 182.) Completely insoluble in strong alcohol. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 182.) Soluble in dilute sulphuric acid. (Geiseler.) Decomposed by all of the hydrogen acids, free sulphuric acid remaining in solution. (Berzelius, *Lehrb.*)

II.) *tri.* (*Turpeth mineral.*) $3HgO, SO_3$ Soluble in 2000 pts. of cold, and in 600 pts. of boiling water. (Fourcroy.) Sparingly soluble in warm dilute sulphuric acid. (H. Rose, *Pogg. Ann.*, **83.** 141.) Readily decomposed to protochloride of mercury (Hg Cl) and dissolved by aqueous solutions of the alkaline chlorides, especially when the solutions are hot. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 182.)

III.) "*acid.*" Has no existence. (H. Rose, *loc. cit.*, pp. 140, 141.)

SULPHATE *of dinoxide & of protoxide* OF MERCURY. $2Hg_2O, SO_3 ; 4HgO, SO_3$ Insoluble in cold water. Not decomposed by boiling water. (Brooke.)

SULPHATE *of protoxide* OF MERCURY & OF POTASH. $3(HgO, SO_3) ; KO, SO_3 + 2Aq$

SULPHATE OF MERCURY with SULPHIDE OF MERCURY. $HgO, SO_3 ; 2HgS$ Insoluble in water. (H. Rose.)

SULPHATE OF METHYL.

I.) *acid.* *Vid.* MethylSulphuric Acid.
$C_2H_3O, HO, 2SO_3$

II.) *normal.* (*Methylic Sulphate. Sulphuric Methylether. Sulphate of Methylene.*) C_2H_3O, SO_3 Slowly decomposed by cold, rapidly by boiling water. Rapidly decomposed by wood-spirit. (Dumas & Péligot.)

SULPHATE OF METHYLAMIN. Very soluble in water. Insoluble in alcohol. (Wurtz, *Ann. Ch. et Phys.*, (3.) **30.** 460.)

"*Bi*SULPHATE OF METHYLENE." *Vid.* MethylSulphuric Acid.

SULPHATE OF METHYL*di*ETHYLAMYLAMMONIUM.

SULPHATE OF METHYLETHYLCONIIN. Deliquescent. Readily soluble in water. (v. Planta & Kekulè, *Ann. Ch. u. Pharm.*, **89.** 139.)

SULPHATE OF METHYLNICOTIN. Soluble in water.

SULPHATE OF METHYLPHENIDIN.

SULPHATE OF METHYLNITROPHENIDIN. $N\left\{\begin{matrix}C_{12}H_4(NO_4)\\C_2H_3\\H\end{matrix}\right. . HO, SO_3$ Easily soluble in water, especially when this is acidulated with sulphuric acid. (Cahours, *Ann. Ch. et Phys.*, (3.) **27.** 449.)

SULPHATE OF METHYLTUNGSTEN. Very deliquescent and soluble in water. Easily soluble in alcohol of 40°. Sparingly soluble in ether. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 75.)

SULPHATE *of protoxide* OF MOLYBDENUM.

I.) *normal.* MoO, SO_3 Decomposed by water into the following basic and acid salts.

II.) *basic.* Insoluble in water.

III.) *acid.* Soluble in water. (Berzelius.)

SULPHATE *of binoxide* OF MOLYBDENUM. $MoO_2, 2SO_3$ Soluble in water.

SULPHATE OF MOLYBDIC ACID.

I.) *normal.* $MoO_3, 3SO_3 + 2Aq$ Deliquescent. Partially soluble in water. (Anderson, in Berzelius's *Lehrb.*)

II.) *basic.* Sparingly soluble in water. Insoluble in alcohol. (Berzelius.)

SULPHATE *of binoxide* OF MOLYBDENUM & OF POTASH. Readily soluble in water. (Berzelius.)

SULPHATE OF MORPHINE.

I.) *normal.* $N\left\{\begin{matrix}C_{34}H_{18}O_6\\H\end{matrix}\right. . HO, SO_3 + 5Aq$ Very readily soluble in water, and alcohol. Soluble in 2 pts. of cold water, the aqueous solution containing 33.33% of it. (M. R. & P.) Soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8**. 201, in Canstatt's *Jahresbericht für* 1854, p. 76.)

II.) *acid.*

Sulphate of Naphtylamin. Soluble in water. Easily soluble in water acidulated with chlorhydric acid. Sparingly soluble in cold alcohol of 86%, more soluble in boiling alcohol. (Béchamp, *Ann. Ch. et Phys.*, (3.) **42**. 189.) Difficultly soluble in cold water or alcohol; slowly but rather abundantly soluble in boiling alcohol, so that the saturated boiling solution becomes completely solid on cooling. (Zinin.) Less soluble in water than sulphate of phthalamin. (Schuetzenberger & Willm.)

(*Sulphate of Naphtalidam. Sulphate of Naphtalidin.*)
$N\left\{\begin{matrix}C_{20}\,H_8{}''\\ H\end{matrix}\right. .\ H\,O, S\,O_3$

Sulphate of Narcein. Sparingly soluble in cold, readily soluble in boiling water.

Sulphate of Narcotin. Soluble in water.

Sulphate of Nickel.

I.) *normal.*

a = anhydrous. 100 pts. of the aqueous solution saturated at its boiling point (112.5°) contain 65 pts. of the dry salt; or 100 pts. of water at 112.5° dissolve 185.71 pts. of it; or 1 pt. of the dry salt is soluble in 0.5384 pt. of water at 112.5°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18**. 90.)

100 pts. of water at °C.	Dissolve of the anhydrous salt, pts.
2°	30.4
16°	37.4
20°	39.7
23°	41.0
31°	45.3
41°	49.1
50°	52.0
53°	54.4
60°	57.2
70°	61.9

(Tobler, *Ann. Ch. u. Pharm.*, **95**. 198, and fig.)

b = hydrated. Efflorescent. Soluble in 3 pts. of water at 12.5°. Insoluble in alcohol or ether. Alcohol precipitates it from the aqueous solution. (Tupputi, *Ann. de Chim.*, 1811, **78**. pp. 153, 154.) 100 pts. of water at 15.5° dissolve 75.6 pts. of the crystallized salt. [T.] Easily soluble in alcohol, and ether. [?] (Berzelius, *Lehrb.*, **3**. 663.)

$Ni\,O, S\,O_3 + 7\,Aq$

Sulphate of nickel may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63**. 444; also in his *Chim. Moléc.*, p. 346.) It crystallizes from its solution in chlorhydric acid.

II.) *basic.* Very slightly soluble in water. (Berzelius.) Incompletely soluble in water, and the portion insoluble in water is only slightly soluble in ammonia-water. (Tupputi, *Ann. de Chim.*, 1811, **78**. 153.)

Sulphate of Nickel & of Potash. Permanent. Sparingly soluble in water. (Proust.) Permanent. Soluble in 8 @ 10 pts. of water at 12.5°. (Tupputi, *Ann. de Chim.*, 1811, **78**. 166.)

$Ni\,O, S\,O_3;\ K\,O, S\,O_3 + 6\,Aq$

100 pts. of water at °C.	Dissolve pts. of the anhydrous salt.
0°	5.3
10°	8.9
14°	10.5
20°	13.8
30°	18.6
36°	20.4
49°	27.7
55°	32.4
60°	35.4
75°	45.6

(Tobler, *Ann. Ch. u. Pharm.*, **95**. 198, and fig.)

Considerably less soluble in water than the corresponding cobalt salt. The aqueous solution saturated (slightly supersaturated), at

20°	contains	8.729%	of the	anhyd. salt.
40°	"	12.270	"	"
60°	"	17.555	"	"
80°	"	22.021	"	"

(C. v. Hauer, *J. pr. Ch.*, 1858, **74**. 435.)

Sulphate of Nickel, of Potash, & of Zinc.

$Ni\,O; S\,O_3;\ 2(K\,O, S\,O_3);\ Zn\,O, S\,O_3 + 12\,Aq$

Sulphate of Nickel & of Zinc. Very efflorescent. Soluble [the 6 Aq salt?] in 3 @ 4 pts. of water at 12.5°. Insoluble in alcohol. Completely soluble in ammonia-water, the solution subsequently undergoing decomposition. (Tupputi, *Ann. de Chim.*, 1811, **78**. pp. 168, 150, 174.)

$Ni\,O, S\,O_3;\ Zn\,O, S\,O_3 + 6\,Aq\ \&\ + 13\,Aq$

Sulphate of Nickel*ter*amin. Decomposed by water. (H. Rose.)

(*AmmonioSulphate of Nickel.*)
$N_3\{H_9\,.\ Ni\,O, S\,O_3$

Sulphate of Nicotin. Readily soluble in water, and alcohol.

$N_2\{(C_{10}\,H_7{}''')_2\,.\ H\,O, S\,O_3$

Sulphate of NiNaphthylamin. Soluble in water. (C. S. Wood.)

$C_{20}\,H_8\,N_2\,O_2, H\,O, S\,O$

Sulphate of (α)NitrAnilin. Soluble in water. (Arppe.)

Sulphate of (β)NitrAnilin.

I.) *normal.* Permanent. Decomposed by water. (Arppe, *Ann. Ch. u. Pharm.*, **93**. 364.)

II.) *acid.*

$N\left\{\begin{matrix}C_{12}\,H_4\,(N\,O_4)\\ H_2\end{matrix}\right. .\ H\,O, H\,O, 2\,S\,O_3$

Sulphate of Nitrous Acid.
(*Sulphate of Nitric Oxide* ($N\,O_2, 2\,S\,O_3$) of Rose.)

a = $N\,O_3, 2\,S\,O_3$ (Bruening, *Ann. Ch. u. Pharm.*, **98**. 382.) Deliquescent. Rapidly soluble in water, with decomposition; also soluble in aqueous solutions of caustic alkalies and of salts. Abundantly soluble in cold concentrated sulphuric acid. (H. Rose.) Insoluble in cold, and but slowly soluble, with decomposition, in hot concentrated sulphuric acid. (Prevostaye.) Slowly soluble in cold concentrated sulphuric acid.

b = Ditto with Sulphuric Acid. Deliquescent. Rapidly soluble in water, with rise of temperature. (W. Henry.)

"$N\,O_2, 2\,S\,O_2;\ 2\,H\,O, S\,O_3$"

Sulphate of NitrAzoPhenylamin. Decomposed by water, but is soluble in water acidulated with sulphuric acid.

$N_2\left\{\begin{matrix}C_{12}\,H_3\,(N\,O_4)''\\ H_4\end{matrix}\right. .\ H\,O, S\,O_3$

Sulphate of NitroCodein. Very soluble in boiling water.

$N\left\{\begin{matrix}C_{36}\,H_{19}\,(N\,O_4)\,O_6{}'\\ H\end{matrix}\right. .\ H\,O, S\,O_3$

Sulphate of NitroCumidin. Soluble in water.

$N\left\{\begin{matrix}C_{18}H_{10}(NO_4)\\H_2\end{matrix}\right. . HO, SO_3 + 2\,Aq$

Sulphate of NitroHarmalin.

I.) *normal.* Soluble in water acidulated with sulphuric acid.

II.) *bi.* Sparingly soluble in cold water.

$N_2\left\{C_{26}H_{13}(NO_4)O_2^{vi} . HO, HO, 2\,SO_3\right.$

Sulphate of NitroHarmin.

I.) *normal.*

II.) *bi.*

Sulphate of NitroMelanilin. Very readily soluble in water. (Hofmann, *J. Ch. Soc.*, **1.** 308.)

Sulphate of NitroMesidin. Decomposed by water. Soluble in water acidulated with sulphuric acid. Soluble in alcohol. (Maule, *J. Ch. Soc.*, **2.** 120.)

Sulphate of NitroPapaverin. Sparingly soluble in water.

Sulphate of NitroTyrosin. Soluble in water.

$2\,C_{18}H_{10}(NO_4)NO_6, 2\,HO, S_2O_6$

Sulphate of Octyl. *Vid.* OctylSulphuric Acid.

Sulphate of Octylamin. Easily soluble in water. (Cahours.)

(*Sulphate of Caprylamin.*)

$N\left\{\begin{matrix}C_{16}H_{17}\\H_2\end{matrix}\right. . HO, SO_3$

Sulphate *of protoxide* **of Osmium.** Easily soluble in water, and alcohol.

$Os\,O, SO_3$

Sulphate *of the blue oxide* **of Osmium.** Insoluble in water. Before drying, it is soluble in aqueous solutions of the caustic and carbonated alkalies.

Sulphate *of binoxide* **of Osmium.** Soluble in water.

$Os\,O_2, 2\,SO_3$

Sulphate of Oxycanthin.

Sulphate of "OxyCobaltiaque" (of Fremy). Permanent. Soluble, without decomposition, in an ammoniacal liquor. Immediately decomposed by water. (Fremy, *Ann. Ch. et Phys.*, (3.) **35.** 277.)

$5\,NH_3 . Co_2O_4, 2\,SO_3 + 3\,Aq$

Sulphate of Palladbiamin. Soluble in warm, less soluble in cold ammonia-water.

$N_2\left\{H_6 . Pd\,O, SO_3 + Aq\right.$

Sulphate of Palladammonium. Easily soluble in boiling, very sparingly soluble in cold water. (Kane, *Phil. Trans.*, 1842, p. 292.)

$N\left\{\begin{matrix}H_3\\Pd\end{matrix}\right. . O, SO_3$

Sulphate of Palladium.

I.) *mono.*

a = anhydrous. Absorbs one equivalent of water from the air without becoming damp. If the air be very damp it subsequently deliquesces completely. (Kane, *Phil. Trans.*, 1842, p. 288.) Decomposed by water, even in the cold, with separation of a basic salt. The water retains sulphuric acid in solution, and this contains traces of oxide of palladium, but no acid salt is formed. (H. Rose, *Pogg. Ann.*, **83.** pp. 143, 140.)

$Pd\,O, SO_3$

b = hydrated. Deliquesces in damp air. Very soluble in water. (Kane, *Phil. Trans.*, 1842, p. 287.) Soluble in water. (Fischer, Berzelius.) When a strong aqueous solution is mixed with much water it is decomposed, a basic salt separating. This precipitation may be prevented by acidulating the solution with sulphuric acid. (Kane, *loc. cit.*, p. 288.)

$Pd\,O, SO_3 + 2\,Aq$

II.) *basic.* Insoluble in water. Easily soluble in chlorhydric acid. (Kane, *Phil. Trans.*, 1842, pp. 288 – 291.) Soluble in ammonia-water.

$8\,Pd\,O, SO_3 + 6\,Aq$ & $+ 10\,Aq$

Sulphate of Palladium & of Potash.

Sulphate of Papaverin.

Sulphate of ***di*****Phenin.** Insoluble in cold water, or in alcohol. Soluble in boiling water acidulated with chlorhydric acid. (Laurent & Gerhardt.)

Sulphate of Phenyl. *Vid.* PhenylSulphuric Acid.

Sulphate of PhenylAcetosamin. Soluble in water, and alcohol.

(*Sulphate of AcetylAnilin.*)

Sulphate of PhenylCarbamic Acid.

$N\left\{\begin{matrix}C_2O_2''\\C_{12}H_5\\H\end{matrix}\right. . HO, HO, SO_3$

Sulphate of Phloramin. Soluble in water.

$C_{12}H_7NO_4, HO, SO_3$

Sulphate of Phthalamin. Soluble in water. More soluble in water than sulphate of naphthylamin. (Schuetzenberger & Willm.)

$NC_{16}H_9O_4, HO, SO_3$

Sulphate of Phthalidin. Much less soluble in water than the chlorhydrate or nitrate. (Dusart.)

$N\left\{\begin{matrix}C_{16}H_8''\\H\end{matrix}\right. . HO, SO_3$

Sulphate of Picolin.

I.) *normal.* Decomposed to an acid salt by boiling with water. Insoluble in an excess of picolin. (Unverdorben.)

II.) *bi.* Readily deliquescent. Very soluble in alcohol. Insoluble in ether. (Anderson.)

$N\left\{C_{12}H_7''' . HO, HO, SO_3\right.$

Sulphate of Piperidin. Deliquescent. Very soluble in water. (Cahours, *Ann. Ch. et Phys.*, (3.) **38.** 84.)

$N\left\{\begin{matrix}C_{10}H_{10}''\\H\end{matrix}\right. . HO, SO_3$

Bi**Sulphate of Platin(*****ic*****)ammonium.** Tolerably easily soluble in warm water. Insoluble in alcohol. (Gerhardt.)

(*Sulphate of Platinamin.*)

$N\left\{\begin{matrix}H_3\\Pt''\end{matrix}\right. . O_2, 2\,SO_3$

Sulphate of Platin(***ous*****)*****bi*****amin.** Soluble in 32 pts. of water at 16 . 5°; and more readily in boiling water. (Reiset, *Ann., Ch. et Phys.*, (3.) **11.** 422.) Soluble in 50 @ 60 pts. of boiling water, and much less soluble in cold water. Almost insoluble in ordinary alcohol. Soluble in dilute sulphuric acid, separating out as the liquor becomes more concentrated, and decomposing after a certain degree of concentration is reached. (Peyrone, *Ann. Ch. et Phys.*, (3.) **12.** pp. 202, 207.)

(*Sulphate of diPlatosamine.*
AmmonioSulphate of protoxide of Platinum.)

$N_2\left\{H_6 . Pt\,O, SO_3\right.$

Sulphate of Platin(***ous*****)ammonium.** Sparingly soluble in cold, more soluble in hot water. (Reiset, *Ann. Ch. et Phys.*, (3.) **11.** 427.) Soluble in ammonia-water with combination. (*Ibid.*, p. 431.)

$N\left\{\begin{matrix}H_3\\Pt\end{matrix}\right. O, HO, SO_3$

Sulphate of PlatinoPyridin. Readily soluble in water.

Sulphate *of protoxide* **of Platinum.** Deliquescent. Soluble in water. (Vauquelin.)

$Pt\,O, SO_3$

Sulphate *of binoxide* **of Platinum.** Deliquescent. Soluble in water, alcohol, and ether (E. Davy); being the only

$Pt\,O_2, 2\,SO_2$

metallic sulphate, except tersulphate of iron, which is readily soluble in alcohol (Gmelin). Also soluble in phosphoric, chlorhydric, and nitric acids. (E. Davy.)

SULPHATE *of binoxide* OF PLATINUM & OF POTASH.

I.) *basic.* Insoluble in water. Readily soluble in aqua-regia, and in boiling chlorhydric acid, but is not attacked by boiling nitric, sulphuric, phosphoric, or acetic acids, or by ammonia-water, or caustic potash. (E. Davy.)

SULPHATE *of binoxide* OF PLATINUM & OF SODA. Resembles the potash salt.

SULPHATE OF PLATOSAMMONIUM. *Vid.* Sulphate of Platin(*ous*)amin.

SULPHATE OF PLATOSOPYRIDIN.

SULPHATE OF *bi*PLUMBIC*tri*ETHYL. Soluble in water, and in alcohol. (Buckton.) Nearly insoluble in water, absolute alcohol, or ether. But readily soluble in water or alcohol when these are acidulated with sulphuric or chlorhydric acid.

(*Sulphate of* $\frac{3}{2}$ *PlombEthyl.*)
$Pb_2(C_4H_5)_3O, SO_3$

SULPHATE OF POTASH. Permanent. Soluble in water, with slight reduction of temperature.
KO, SO_3

100 pts. of water at	0°	dissolve	8.36	pts. of it.
"	12.72°	"	10.57	"
"	49.08°	"	16.91	"
"	63.90°	"	19.29	"
"	101.50°	"	26.33	"

(Gay-Lussac, *Ann. Ch. et Phys.*, (2.) **11.** 311.)
The curve of solubility of sulphate of potash is,

$$y = 0.1741x^\circ + 8.36.$$

(Gay-Lussac, *loc. cit.*)

Or 100 pts. of water dissolve pts. =

$$8.36 + 0.1741\ T^\circ.$$

(H. Kopp, *Ann. Ch. u. Pharm.*, 1840, **34.** 261.)

That is to say, 100 pts. of water at 0° dissolve 8.36 pts. of it, and for every degree above 0° 0.1741 pt.

By direct experiment Kopp found that 100 pts. of water at 15.1° dissolved 10.2 pts. of the salt; according to the above formula 11 pts. should have been dissolved.

Soluble in	9.96	pts. of water at	12.5°
"	9.6	"	15°
"	6.8	"	31.25°
"	5.84	"	37.5°
"	4.0	"	50°
"	4.4	"	56.25°
"	4.5	"	68.75°
"	4.0	"	87.5°
"	3.7	"	100°

Or 100 pts. of water

at 12.5°	dissolve	10	pts. of it.
" 15°	"	10.38	"
" 31.25°	"	14	"
" 37.5°	"	17	"
" 50°	"	25	"
" 56.25°	"	22	"
" 68.75°	"	21.95	"
" 87.5°	"	25	"
" 100°	"	26	"

Or the aqueous solution saturated at °C.	Contains per-cent of it.
12.5°	9.125
15°	9.400
31.25°	12.812
37.5°	14.600
50°	20.000
56.25°	18.500
68.75°	18.000
87.5°	20.000
100°	21.100

(R. Brandes & Firnhaber, from *Stoltze's Berl. Jahrb., Jahrg.* 2. *Abth.*, 68–74, in *Brandes's Archiv.*, 1823, **5.** 91.)

The saturated aqueous solution boils at 103°. (Kremers, *Pogg. Ann.*, **99.** 43.) 100 pts. of the aqueous solution saturated at the boiling point (101.7°), contain 17.5 pts. of the dry salt; or 100 pts. of water at 101.7 dissolve 21.212 pts. of it; or 1 pt. of the salt is soluble in 4.714 pts. of water at 101.7°. (Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) 100 pts. of water at 102.8° dissolve 29 pts. of it. (Penny, *Phil. Mag.*, (4.) **10.** 406.) The aqueous solution saturated at 18.75° is of 1.0798 sp. gr.; it contains 9.71% of the salt; or 100 pts. of water at 18.75° dissolve 10.74 pts. of it; or, in other words, 1 pt. of the salt is soluble in 9.3 pts. of water at 18.75°. (Karsten, *Berlin Abhandl.*, 1840, p. 101. The aqueous solution saturated at 12.5° contains 6.4% of it. (Hassenfratz, *Ann. de Chim.*, **28.** 291.) The cold saturated aqueous solution contains 5.2% of it (Fourcroy); when saturated at 10° it contains 15.7%. (Eller, cited by Hassenfratz.) 100 pts. of water at 15.5° dissolve 7.3 @ 6.25 pts. of it, and at 100°, 20 pts. (Ure's *Dict.*) 100 pts. of boiling water dissolve 24.2 pts. of it. (Wenzel, *Verwandtschaft*, p. 310 [T.].)

Soluble in 9.081 pts. of water at 15°. (Gerlach's determination, see his table of sp. grs., below.) Soluble in 16 pts. of water at 15°, and in 5 pts. of boiling water. More readily soluble in acidulated than in pure water. (Bergman, *Essays*, **1.** pp. 177, 34, 378.) Soluble in 18 pts. of cold, and in 4 pts. of boiling water (Fourcroy); in 15 pts. of cold and 5 pts. of hot water (Reid); in 12 pts. of water at 0°, and in 4 pts. at boiling; in 9.41 pts. of water at 12.2°, and in 3.8 pts. at boiling the solution saturated at 12.2° containing 9.56% of it, and that saturated at boiling 20.8%. (M. R. & P.) Soluble in 12 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.) According to Redwood, powdered sulphate of potash is more soluble in water than the crystallized salt. The aqueous solution saturated at 15° is of 1.077443 sp. gr., and contains dissolved in every 100 pts. of water at least 10.055 pts. of the salt. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.)

An aqueous solution of sp. gr., at 19.5° (sp. gr. of water at 19.5° = 1).	Contains	
	Percent of KO, SO_3.	Pts. of KO, SO_3 dissolved in 100 pts. of water.
1.0193	2.401	2.46
1.0385	4.744	4.98
1.0568	6.968	7.49
1.0763	9.264	10.21
1.0909	10.945	12.29

(Kremer's *Pogg. Ann.*, **95.** 120. The second column is from Gerlach's *Sp. Gew. der Salzlœsungen*, p. 34.)

An aqueous solution of sp. gr. at 15° (sp. gr. of water at 15° = 1).	Contains percent of KO, SO_3.
1.00820	1
1.01635	2
1.02450	3
1.03277	4
1.04105	5
1.04947	6
1.05790	7
1.06644	8
1.07499	9
1.08305	9.92*

(Th. Gerlach, *Sp. Gew. der Salzlœsungen*, 1859, p. 21.)

* Saturated solution.

A solution of sp. gr. at 12.5°.	Contains of K O, S O_3 percent.
1.0086	1
1.0171	2
1.0257	3
1.0343	4
1.0429	5
1.0515	6

(Hassenfratz, *Ann. de Chim.*, **28.** 296.)

An aqueous solution of sp. gr. at 12.5°	Contains for every 100 pts. of water, pts. of K O, S O_3	Boils at °C.
1.00795	1	100.38°
1.01510	2	100.63°
1.02310	3	100.75°
1.03050	4	100.88°
1.03905	5	101°
1.04555	6	101.12°
1.05240	7	101.25°
1.05990	8	101.25°
1.06760	9	101.38°
1.07350	10	100.5°

The most concentrated solution boils at 102.88°. (R. Brandes & Gruner, *Brandes's Archiv.*, 1827, **22.** 147.) An aqueous solution saturated at 8° is of 1.072 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24.** 211.) An aqueous solution containing 9% of K O, S O_3 boils at 100.3°. (Gerlach, *loc. cit.*, p. 105.)

A solution (saturated at 15°) in alcohol of Sp. gr.	Percent, by weight	Contains percent of K O, S O_3
1.000	0	10.4
0.986	10	3.9
0.972	20	1.46
0.958	30	0.55
0.939	40	0.21

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.) Sulphate of potash is more soluble in aqueous solutions of other salts, as the sulphates of soda, magnesia, and copper, than in pure water. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 227.) Soluble in saturated aqueous solutions of the sulphates of soda, and of magnesia, and of chloride of sodium; in a saturated solution of sulphate of zinc or of copper it is slowly converted into a double salt. (Karsten, *Berlin Abhandl.*, 1840, p. 127.) Sparingly soluble in a saturated solution of chloride of potassium without occasioning any precipitation. The solution thus obtained contains at 18.75° 25.78% of mixed salt: or 100 pts. of water dissolve 34.75 pts. of mixed salt, viz. 32.96 pts. of K Cl, and 1.79 pts. of K O, S O_3. A solution identical with this is obtained when an excess of a mixture of the two salts is treated with water. (Karsten, *loc. cit.*, p. 112. See also Chloride of Potassium.) Soluble in a saturated solution of chloride of ammonium. A solution thus prepared at 18.75° contains 33.88% of mixed salt. 100 pts. of water consequently dissolve 51.2 pts. of mixed salt, viz. 37.97 pts. of N H_4 Cl, and 13.26 pts. of K O, S O_3. This solution is not of very different composition from that prepared by treating an excess of a mixture of the two salts with water at the same temperature, this last contains 32.86% of mixed salt; 100 pts. of water dissolving 51.2 pts. of mixed salt, viz. 13.28 pts. of K O, S O_3 and 37.92 pts. of N H_4 Cl. (Karsten, *loc. cit.*, p. 120.)

Sparingly soluble in a saturated solution of nitrate of potash without causing any precipitation of the latter. The solution thus obtained contains 25.1% of mixed salt, or 100 pts. of water at 18.75° dissolve 33.51 pts. of mixed salt, viz. 29.48 pts. of K O, N O_5, and 4.03 pts. of K O, S O_3. A solution identical with this is obtained when an excess of a mixture of the two salts is treated with water. (Karsten, *loc. cit.*, p. 112. See also Nitrate of Potash.) Soluble in a saturated solution of nitrate of soda, forming a clear solution at first, but this soon becomes cloudy from separation of K O, N O_5. (Karsten, *loc. cit.*, p. 124.) Soluble in a saturated solution of nitrate of soda, from which solution the sulphate of potash is not displaced by salts which would precipitate it from its solution in pure water. (Margueritte, *C. R.*, **38.** 307.)

On mixing a very concentrated solution of sulphate of ammonia with a strong solution of acetate of potash a considerable quantity of sulphate of potash falls as a precipitate. (G. Bischof, *Schweigger's Journ. für Ch. u. Phys.*, 1827, **51.** 232.) When one equivalent of K O, S O_3, in aqueous solution, is mixed with a solution of an equivalent of chloride of zinc (Zn Cl) $\frac{176}{1000}$ of it are decomposed to sulphate of zinc, which may be precipitated by adding alcohol, while $\frac{824}{1000}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of manganese (Mn Cl), $\frac{425}{1000}$ of it are decomposed as before, while $\frac{575}{1000}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of magnesium (Mg Cl), $\frac{43}{100}$ of it are decomposed, while $\frac{57}{100}$ of it remain unchanged; when mixed with a solution of an equivalent of acetate of soda (C_4 H_3 Na O_4), $\frac{365}{1000}$ of it are decomposed, while $\frac{635}{1000}$ of it remain unchanged. (Malaguti, *Ann. Ch. et Phys.*, 1853, (3.) **37.** 203.)

Sulphate of potash is precipitated from concentrated aqueous solutions on the addition of ammonia-water. (Sullivan, *Rep. Br. Assoc.*, 1859, p. 302.)

It is insoluble in an aqueous solution of caustic potash, the sp. gr. of which equals 1.35. (Liebig, *Ann. Pharm.*, **11.** 262.)

Insoluble in alcohol, the sp. gr. of which equals 0.905. (Anthon, *J. pr. Ch.*, **14.** 125.) Almost completely insoluble in absolute alcohol; somewhat more, though still exceedingly sparingly, soluble in absolute alcohol which has been acidulated with sulphuric acid. (Fresenius, *Quant.*, p. 751.)

Glacial acetic acid produces no precipitate when added to the aqueous solution. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 443.) Soluble in acetic acid, without decomposition; in chlorhydric acid, with formation of K O, 2 S O_3 and K Cl; in warm strong nitric acid to K O, 2 S O_3, K O, N O_5, and (K O, S O_3; H O, N O_5) [see Nitrate of Sulphate of Potash]; in phosphoric acid, with formation of (K O, S O_3; 3 H O, P O_5) [see Phosphate of Sulphate of Potash]; and in the strong acids generally. (Berzelius, *Lehrb.*, **3.** 118.)

Soluble in glycerin. (Pelouze.)

II.) *bi.*

a = *anhydrous*. Effloresces slightly upon its K O, 2 S O_3 surface. Soluble in 6 pts. of water at 16° (Dumas, *Tr.*, **6.** 219); in 5 pts. of water at 15.6° [Y.]; in 2 pts. of cold, and in 0.5 pt. of boiling water. (Schubarth's *Tech. Ch.*)

1 pt. of the anhydrous salt is soluble in

2.95	pts. of water at	0°
2.08	" "	20°
1.59	" "	40°
0.68	" "	100°

(Kremers, *Pogg. Ann.*, **92.** 499.)

Soluble in 2 pts. of cold, and in less than 1 pt.

of boiling water. Alcohol precipitates the monosulphate when added to the aqueous solution. (Berzelius, *Lehrb.*) The saturated aqueous solution boils at 108° (Kremers, *loc. cit.*); at 105.5°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) It is soluble in hot water without decomposition so long as the quantity of water used is less than sufficient to dissolve all of the salt which is present; but as soon as sufficient hot water to entirely dissolve the salt is added partial decomposition ensues, a portion of the sulphuric acid being abstracted by the water. (H. Rose, *Pogg. Ann.*, **82.** 549.) Soluble in about half its weight of boiling water, the solution solidifying on cooling. From a solution in a larger quantity of hot water a considerable quantity of the monosulphate crystallizes out on cooling, leaving free acid in the solution, and this in proportion to the amount of water employed, up to a certain limit. (Geiger.) When much water is present, the addition of even a large quantity of sulphuric acid cannot prevent the simple sulphate from crystallizing out. (Graham.) When the water is in large excess its affinity for the sulphuric acid overcomes that of the sulphate of potash for the latter. Cold water extracts from the salt a large quantity of sulphuric acid and but little potash, leaving monosulphate of potash. Boiling alcohol also extracts from the crystals scarcely anything but sulphuric acid. (Geiger, *et al.* See *Gmelin's Handbook*, **3.** 42.) Bisulphate of potash is liable to form supersaturated solutions. (Ogden.)

b = hydrated. Soluble in water.
$KO, HO, 2SO_3$

III.) *mixtures, as*
$2(KO, SO_3); HO, SO_3$ (of Phillips, and of Jacquelain).
$4(KO, SO_3); HO, SO_3$ (of Mitscherlich), &c., &c.

Obtained by dissolving mixtures of KO, SO_3 and $KO, 2SO_3$ in water, and crystallizing. These compounds are decomposed by a small quantity of water, which dissolves out the bisalt in preference to the monosalt, but if sufficient water be added the latter is of course also dissolved.

SULPHATE OF POTASH & OF RHODIUM.

I.) $KO, SO_3; Rh_2O_3, 3SO_3$ Almost insoluble in water. Very sparingly soluble in sulphuric acid. (Berzelius's *Lehrb.*)

II.) ? Very slowly soluble in cold, quickly soluble in boiling water. (Berzelius's *Lehrb.*)

SULPHATE OF POTASH & OF SILVER.

SULPHATE OF POTASH & OF SODA.

I.) Soluble in water.
$KO, SO_3; NaO, SO_3$

II.) 100 pts. of water at 103° dissolve nearly 40.8 pts. of this salt. (Penny, *Phil. Mag.*, (4.) **10.** 406.)
$3(KO, SO_3); NaO, SO_3$
(*Plate Sulphate of Potash.*)

III.) $5(KO, SO_3); NaO, SO_3$

1000 pts. of water at 100° dissolve 250 pts. of it.
" " 12.7° " 101 "
" " 4.4° " 92 "
(Gladstone, *J. Ch. Soc.*, **6.** 111.)

SULPHATE OF POTASH & OF STRONTIA.
$KO, SO_3; SrO, SO_3$

SULPHATE OF POTASH & OF THORIA. Permanent. Slowly soluble in cold, but easily and abundantly soluble in hot water. Completely insoluble in a saturated cold solution of sulphate of potash. Insoluble in alcohol. On boiling the aqueous solution slight decomposition occurs after some time, a basic salt, insoluble in water, but easily soluble in acids, being deposited. This decomposition, however, cannot be carried beyond a certain point. (Berzelius, *Pogg. Ann.*, 1829, **16.** pp. 410, 400, 390.)
$KO, SO_3; ThO, SO_3 + Aq$

SULPHATE OF POTASH & OF TITANIUM. Decomposed by water.

SULPHATE OF POTASH & *of protoxide* OF URANIUM. Very difficultly soluble in water. (Rammelsberg.)
$KO, SO_3; 2(UrO, SO_3) + Aq$

SULPHATE OF POTASH & *of sesquioxide* OF URANIUM.

I.) Permanent. 100 pts. of water dissolve 11 pts. of it at 22°, and 196 pts. at 100°; or 1 pt. of the salt is soluble in 9.09 pts. of water at 22°, and in 0.51 pt. at 100°. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 211.) Rather sparingly soluble in water. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 43.)
$KO, SO_3; Ur_2O_3, SO_3 + 2Aq$

Ebelmen could not prepare the salts described by Berzelius.

II.) Completely soluble in water. Insoluble in alcohol, which abstracts $\frac{1}{3}$ of the Ur_2O_3, SO_3, and converts it into No. 1. (Berzelius's *Lehrb.*, **3.** 1109.) Insoluble in alcohol. (Berzelius.)
$2(KO, SO_3); 3(Ur_2O_3, SO_3) + Aq$

SULPHATE OF POTASH & OF URANOSOURANIC OXIDE. Nearly or quite insoluble in water. (Berzelius.)

SULPHATE OF POTASH & *of binoxide* OF VANADIUM. Soluble in water. Insoluble in alcohol.
$KO, SO_3; VO_2, 2SO_3$

SULPHATE OF POTASH & OF VANADIC ACID. Very sparingly soluble in water. Insoluble in alcohol.
$KO, SO_3; VO_3, 3SO_3$

SULPHATE OF POTASH & OF YTTRIA. Completely, though very slowly, soluble in a large proportion of water.
$KO, SO_3; YO, SO_3$

Less soluble than sulphate of yttria (Gahn), but more soluble than the sulphate of potash and of cerium. (Gahn & Berzelius.) Soluble in 16 pts. of cold water, and in 10 pts. of water saturated with sulphate of potash, and in still less of the latter if it likewise contains an ammoniacal salt or free acid. (Berlin.)

SULPHATE OF POTASH & OF ZINC. Permanent. Soluble in 5 pts. of cold water. (Bucholz, Jr.)
$KO, SO_3; ZnO, SO_3 + 6Aq$

100 pts. of water at °C	Dissolve pts. of the anhydrous salt.
at 0°	12.6
10°	18.7
15°	22.5
25°	28.8
36°	39.9
45°	51.2
50°	54.0
58°	67.6
65°	81.3
70°	87.9

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

1 pt. of the 6 Aq salt is soluble in 6.76 pts. of water at 15°, or 100 pts. of water at 15° dissolve 14.8 pts. of it; or the aqueous solution saturated at 15° contains 12.9% of it, or 9.9% of the anhy-

drous salt, and is of 1.0939 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.)

Pierre describes a salt to which he attributes the composition (KO, SO_3; $ZnO, SO_3 + 7$ Aq), soluble in 2.5 pts. of boiling water, and much less soluble in cold water. (Pierre, *Ann. Ch. et Phys.*, (3.) **16.** 243.)

Sulphate of Potash & of Zirconia. Very sparingly soluble in water. Entirely insoluble in an aqueous solution of sulphate of potash. Soluble in solutions of carbonate of ammonia and carbonate of potash. Tolerably soluble in acids. When only slightly washed it dissolves readily in water, but after having been thoroughly washed or boiled with water a basic salt is formed, which is insoluble in water, and insoluble, or very nearly so, in acids, a large quantity of concentrated acid being required to dissolve it. (Berzelius.)

Sulphate of PurpureoCobalt.

$5NH_3 . Co_2O_3, 4SO_3 + 5$ Aq

I.) *acid.* Very soluble in water. (Gibbs & Genth, *Smithson. Contrib.*, vol. **9.**)

Sulphate of Quinidin.

$N_2 \{ C_{40}H_{24}O_4^{VI} . HO, SO_3 + 6$ Aq

I.) *normal.* Soluble in 350 pts. of water at 10°, and in 25 pts. of boiling water. Soluble in 32 pts. of absolute alcohol at 10°. Almost insoluble in ether.

Soluble in 340 pts. of water at 12.7°. (Herapath, *Phil. Mag.*, (4.) **6.** 174.)

II.) *acid.* Soluble in 73 pts. of cold, and in 4.2 pts. of boiling water. (Howard.)

Sulphate of Quinine.

Improperly called "basic."

$N_2 \{ C_{40}H_{24}O_4^{VI} . HO, SO_3 + 7$ Aq

I.) *normal.* Efflorescent. Less soluble in water than the bisulphate, and less soluble in cold water than the normal sulphate of cinchonine. Soluble in 740 pts. of water at 13° (the saturated cold solution containing 0.136% of it); and in about 30 pts. of water at 100° (the boiling saturated solution containing 3.25% of it). (Van Heijningen.) Quickly efflorescent. Soluble in 740 pts. of water at 13°, and in about 30 pts. at 100°. Soluble in about 60 pts. of alcohol, of 0.85 sp. gr., at the ordinary temperature, but much more soluble in boiling alcohol. (Baup, *Ann. Ch. et Phys.*, 1824, (2.) **27.** 329.) Soluble in 740 pts. of water at 15.5°; also soluble in acetic acid. (Herapath, *Phil. Mag.*, (4.) **6.** 174.) Soluble in 719.98 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 75.) The saturated cold solution contains 0.136% of it, and the boiling saturated solution 3.25%.

According to Howard, 1 pt. of sulphate of quinine does not dissolve completely in 24 pts. of boiling water, but dissolves when the water is increased to 33.5 pts. On being cooled and allowed to stand for 24 hours, 90% of the sulphate crystallizes out, only 10% of it remaining dissolved; i. e. 1 pt. of crystallized sulphate of quinine is soluble in 335 pts. of cold, and in 33.5 pts. of boiling water. (Cited by Bussy & Guibourt, *Journ. de Pharm. et Chim.*, 1852, (3.) **22.** pp. 406, 404, note.) On repeating Howard's experiment, it was found that 1 pt. of the crystallized sulphate is soluble in 265 pts. of water at 15°, and in 24 pts. of boiling water. (Bussy & Guibourt, *loc. cit.*, and p. 414.)

When 2 grms. of sulphate of quinine are treated with 15 grms. of cold alcohol of 90% the salt does not appear to dissolve sensibly; on heating the alcohol to boiling, the salt dissolves completely, crystallizing out again for the most part as the solution cools. (Bussy & Guibourt, *loc. cit.*, p. 407.)

Freely soluble in glycerin. (Parrish's *Pharm.*, p. 236.) Easily soluble in water acidulated with sulphuric acid, a solution of 1 pt. of the salt in 11 pts. of liquid being readily obtained at the ordinary temperature. It is less easily dissolved by an alcoholic solution of sulphuric acid, a very much larger excess of the acid being required in this case in order to obtain a solution as strong as that mentioned above. (Bouchardat, *Ann. Ch. et Phys.*, (3.) **9.** 240.) Soluble in 57 pts. of cold absolute alcohol, and in 63 pts. of cold alcohol of 90%. (Bussy & Guibourt, *Journ. de Pharm. et Chim.*, 1852, (3.) **22.** 414.) Almost insoluble in ether.

The dissolution of sulphate of quinine in water is remarkably favored in the presence of nitrate of potash, chloride of sodium, and especially of chloride of ammonium. (Calloud, *Bull. de Thérap.*, **58.** 307.)

Tincture of perchloride of iron is one of the best solvents of sulphate of quinine. (Parrish's *Pharm.*, p. 511.) Insoluble in chloroform. (Schlimpert, *Kopp & Will's J. B. für* 1859, p. 405.)

(Improperly called "neutral.")

$N_2 \{ C_{40}H_{24}O_4^{VI} . HO, HO, 2SO_3 + 14$ Aq

II.) *acid* or *bi.* Permanent. Much more soluble in water than the normal salt. Soluble in 11 pts. of water at 13°, and in 8 pts. at 22°. It melts in its water of crystallization at 100°. Easily soluble in alcohol, being much more soluble in warm than in cold alcohol, either weak or strong. (Baup, *Ann. Ch. et Phys.*, 1824, (2.) **27.** 330.) Soluble in concentrated acetic acid.

Sulphate of Quinolein (or Chinolin). Very deliquescent. Soluble in water, and alcohol. Insoluble, or nearly insoluble, in ether. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 171.) Easily soluble in water, and alcohol. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **7.** 252.)

Sulphate of Retinin. Slightly deliquescent. Very readily soluble in water.

Sulphate *of protoxide* of Rhodium. Insoluble in water, or acids. Half its acid is extracted by potash-lye. (Berzelius.)

Sulphate *of sesquioxide* of Rhodium.

$Rh_2O_3, 3SO_3$

a = *anhydrous.* Deliquescent. Very slowly soluble in water, at first sight appearing to be insoluble. (Berzelius, *Lehrb.*)

b = *hydrated.* Easily soluble in water. (Berzelius.)

Sulphate of RoseoCobalt.

$5NH_3 . Co_2O_3, 3SO_3 + 5$ Aq

I.) *normal.* Nearly insoluble in cold, sparingly soluble in boiling water. Neutral solutions are easily decomposed by boiling. Soluble in dilute ammonia-water. (Gibbs & Genth, *Smithson. Contrib.*, vol. **9.** p. 13 of the memoir.) Very sparingly soluble in water. (Fremy, *Ann. Ch. et Phys.*, (3.) **35.** 300.)

$5NH_3 . Co_2O_3, 5SO_3 + 5$ Aq

II.) *acid.* Very soluble in water, without decomposition. Decomposed by boiling with ammonia-water. (Fremy, *loc. cit.*, p. 298.) This "acid salt" has no real existence. (Gibbs & Genth, *loc. cit.*, p. 12.)

$RuO_2, 2SO_3$

Sulphate *of binoxide* of Ruthenium. Deliquescent. Readily soluble in water. (Claus.)

Sulphate of Sanguinarin. Permanent. (Probst.) Soluble in water, and alcohol. Insoluble in ether. (Schiel, *Am. J. Sci.*, (2.) **20.** 220.) Easily soluble in water, and ordinary alcohol; more difficultly soluble in absolute alcohol. Insoluble in ether. (Probst, *Ann. der Pharm.*, 1839, **29.** 121.)

Sulphate of Sarcin. Decomposed by water.

Sulphate of Sarcosin. $N \left\{ \begin{matrix} C_2\,H\,O_2 \\ C_4\,H_5 \\ H \end{matrix} \right. . O_2, H\,O, S\,O_3 + Aq$ Very easily soluble in water. Difficultly soluble in cold, but soluble in 10 @ 12 pts. of boiling alcohol. (Liebig.)

Sulphate of Silver. $Ag\,O, S\,O_3$ Soluble in 200 pts. of cold, and in less than 100 pts. of boiling water. Insoluble in alcohol. (Wittstein's *Handw.*) Nearly insoluble in cold water. Soluble in 88 pts. of boiling water, the saturated solution containing 1.2% of it. (Schnaubart.) Soluble in 87.25 pts. of water. (Wenzel [T.].) Soluble in 68.85 pts. of water at 100°. The saturated aqueous solution boils at 100°. (Kremers, *Pogg. Ann.*, **92.** 499.) 100 pts. of water at 15.5° dissolve 1.15 pts. of it. (Ure's *Dict.*) Soluble in 160 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 75.) More soluble in water acidulated with sulphuric acid than in pure water; still more soluble in nitric acid, and yet more abundantly in concentrated sulphuric acid, from which it is precipitated on the addition of water. (Schnaubart.) Abundantly soluble in a hot mixture of concentrated sulphuric acid and monobromobenzin, less soluble in cold ditto. (Couper, *Ann. Ch. et Phys.*, (3.) **52.** 311.) Soluble in nitric acid, without decomposition. (Klaproth [T.].) Decomposed by aqueous solutions of the soluble hyposulphites, with formation of sulphide of silver. (Herschel, *Edin. Phil. Journ.*, 1819, **1.** 397.) Soluble in an aqueous solution of carbonate of ammonia.

Sulphate of Sinapin.

I.) *normal.* Extremely soluble in water. (v. Babo & Hirschbrunn.)

II.) *acid.* $N \left\{ C_{32}\,H_{23}\,O_{10}, 2\,H\,O, 2\,S\,O_3 + 4\,Aq \right.$ Easily soluble in water, and in boiling alcohol. Almost insoluble in ether. (v. Babo & Hirschbrunn.) Almost insoluble in water. Insoluble, or very sparingly soluble, in cold, soluble in boiling absolute alcohol.

Sulphate of Sinkalin. Deliquescent. Soluble in water. (v. Babo & Hirschbrunn.)

Sulphate of Soda.

a = *anhydrous.* $Na\,O, S\,O_3$ The anhydrous salt separates from solutions which are evaporated at temperatures approaching 100°.

A solution saturated at 33° deposits crystals of the anhydrous salt at 100°. (Faraday.)

It crystallizes from saturated solutions maintained at a temperature from 33° to 40°. (Berzelius, *Lehrb.*) [This statement does not seem to be in accordance with the experiments of Brandes & Firnhaber. See below.]

1 pt. of the anhydrous salt is soluble in 7.367 pts. of water at 15° (Gerlach's determination, see his table of sp. grs., below); in 8.52 pts. of water at 13.3° (Poggendorff, cited by Kremers, *Pogg. Ann.*, **85.** 247); in 10 pts. of cold water. (Schubarth's *Tech. Ch.*) 1 pt. of the pulverized ignited salt is soluble in 3.3 pts. of water at 62.2°. (Wenzel, *Verwandtschaft*, p. 309 [T.].) 100 pts. of water at 0° dissolve 5.155 pts. of the anhydrous salt (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 226); and at 13.8°, 10.58 pts. [T.].) An aqueous solution saturated at the temperature of boiling, 100.6°, contains 31.5% of the dry salt; or 100 pts. of water at 100.6° dissolve 45.985 pts. of it; or 1 pt. of the dry salt is soluble in 2.174 pts. of water at 100.6°. In this experiment crystals of the 10 Aq salt were liquefied by heat and this solution boiled. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.)

The saturated aqueous solution boils at 105°. (Kremers, *Pogg. Ann.*, **99.** 43.) An aqueous solution containing 5% of $Na\,O, S\,O_3$ boils at 100.3°; one of 10% at 100.8°. (Gerlach's *Sp. Gew. der Salzlœsungen*, p. 104.)

(See also under *c.*)

b = $Na\,O, S\,O_3 + 7\,Aq$ According to Lœwel, this hydrate contains only 7 equivalents of water, and not 8, as was supposed by Faraday & Ziz, and by Lœwel himself, in his earlier memoirs. Efflorescent. Insoluble in alcohol. (Lœwel, *Ann. Ch. et Phys.*, (3.) **33.** pp. 334, 335.) It crystallizes out from the fused 10-hydrated salt at a temperature of 12°; and from a solution of this salt in half its own weight of water at 7°, and above that temperature if the fluid remains undisturbed in a covered vessel. (Ziz.)

(See also under *c.*)

c = $Na\,O, S\,O_3 + 10\,Aq$ (*Glauber's Salt. Common crystallized Sulphate of Soda.*) Effloresces completely to anhydrous $Na\,O, S\,O_3$. (Brandes & Firnhaber, *Brandes's Archiv.*, 1824, **7.** 172.)

Soluble in 2.33 pts. of water at 19°; or 100 pts. of water at 19° dissolve 42.8 pts. of it; or the aqueous solution saturated at 19° contains 29.9% of it, or 13.2% of the anhydrous salt, and is of 1.1222 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.)

100 pts. of water at °C.	Dissolve of the anhyd. salt, $Na\,O, S\,O_3$, pts.	 of the cryst. salt, $Na\,O, S\,O_3 + 10\,Aq$, pts.
0°	5.02	12.17
11.67°	10.12	26.38
13.30°	11.74	31.33
17.91°	16.73	48.28
25.05°	28.11	99.48
28.76°	37.35	161.53
30.75°	43.05	215.77
31.84°	47.37	270.22
32.73°	50.65	322.12
33.88°	50.04	312.11
40.15°	48.78	291.44
45.04°	47.81	276.91
50.40°	46.82	262.35
59.79°	45.42	
70.61°	44.35	
84.42°	42.96	
103.17°	42.65	

(Gay-Lussac, *Ann. Ch. et Phys.*, (2.) **11.** 312.)

The solubility of sulphate of soda increases rapidly with the temperature below 30°; above 40° it slowly decreases; and the two curves thus formed cannot be united as one. The body which dissolves at temperatures below 30° must consequently be different from that which occurs in solution above 40°. The maximum point of solubility is not a property of one of these curves, but is formed by their meeting each other, and lies at the point of decomposition. From the observations (Gay-Lussac's) under 30° the formula of this curve is: 100 pts. of water dissolve of the salt, pts., = $5.02 + 0.30594\ T° - 0.000410\ T^2$

$+ 0.0009977\ T^3$. From the observations (Gay-Lussac's) above 40° the formula of the other curve is: 100 pts. of water dissolve of the salt, pts. $= 58.50 - 0.27783\ T^{\circ} + 0.0006900\ T^2 + 0.0000049802\ T^3$. At the point of intersection of the curves the two formulæ are equivalent. $0.00009927\ T^3 + 0.001100\ T^2 - 0.58377\ T + 5348 = 0$, which equation affords $T = 32.93$. Thus the decomposition occurs at 33°, as has also been shown by direct experiment. At this temperature the crystallized sulphate of soda, whether in water, or by itself, passes into the anhydrous state. (H. Kopp, *Ann. Ch. u. Pharm.*, 1840, **34.** 271.)

1 pt. of the 10 Aq salt is soluble in

8.7666	pts. of water at	2.5°
6.1034	"	7.5°
3.4438	"	12.5°
1.4123	"	18.75°
0.6974	"	25°
0.2083	"	31.25°
0.3401	"	37.5°
0.3831	"	43.75°
0.3875	"	50°
0.4030	"	56.25°
0.4500	"	62.5°
0.4117	"	68.75°
0.4173	"	75°
0.4603	"	81.25°
0.4532	"	87.5°
0.4435	"	93.75°
0.4137	"	100°

Or 100 pts. of water at °C.	Dissolve of $Na\,O, S\,O_3 + 10\,Aq$, pts.
2.5°	11.39
7.5°	16.38
12.5°	29.03
18.75°	70.78
25°	143.38
31.25°	479.97
37.50°	294.04
43.75°	261.04
50°	285.06
56.25°	248.11
62.5°	222.22
68.75°	242.88
75°	241.68
81.25°	217.20
87.50°	220.65
93.75°	225.46
100°	241.69

Or the aqueous solution saturated at °C.	Contains percent of $Na\,O, S\,O_3 + 10\,Aq$
2.5°	10.239
7.5°	14.078
12.5°	22.503
18.75°	41.454
25°	58.913
31.25°	82.758
37.50°	74.622
43.75°	73.302
50°	72.072
56.25°	71.274
62.5°	68.965
68.75°	70.836
75°	70.733
81.25°	68.475
87.5°	68.813
93.75°	69.275
100°	70.734

"These results prove that the capacity of solution of the water decreases from 37.5° to 100°, and that oscillations occur in the capacities at the intermediate degrees of temperature. Thus, at 68.75°, for example, the capacity of solution of the water is greater than at 75°, 81.25°, or 62.5°. In general, however, the differences of the capacities between 37.5° and 100° are very small, and the largest capacity of solution appears to be at 31.25°." (B. & F. *loc. inf. cit.*, p. 159.) The determinations for temperatures between 2.5° and 18.75° were made with solutions prepared by agitating a large excess of the 10-Aq salt with water at the given temperatures. Those for temperatures between 25° and 100° were made with solutions obtained by adding powdered salt to water, maintained at the given temperatures, until a "very perceptible" portion of the salt remained undissolved [hence, probably, the formation of supersaturated solutions, by which these results appear to have been vitiated?]. In the experiment at 31.25° a portion of the salt separated out in hard lumps. So also when the 10 Aq salt is heated by itself, beginning to melt in its water of crystallization at 31.25°, it is completely fluid at 37.5°, but at the same time hard masses separate out from this solution; and these lumps will not redissolve on continuing to heat the solution, even when its temperature is elevated to 100°, and maintained thereat for some time; the addition of a certain amount of water being necessary in order to dissolve the salt which has separated. By direct experiment it was found on melting a portion of the 10 Aq salt, heating to 75° the liquid obtained, and adding water, drop by drop, until the portions of salt which had at first separated were redissolved, that the solution thus obtained at 75° was of almost identical composition with that previously obtained at 75°, and recorded in the table above.

The salt of which these hard lumps are composed is a hydrate containing less water than the ordinary (10 Aq) salt, but its content of water is not constant, the proportion being less according as the temperature at which the salt separated is higher. In six experiments made at various temperatures in order to test this point, the percentage of water varied from 42.65 in the salt separated at 37.5° to 14.5 in the salt which separated at 100° (the percentage of water in the 10 Aq salt being 55.83). Experiments upon the amounts of salt which separated at various temperatures, between 37.5° and 100°, from the melted 10 Aq salt indicated a slight increase in quantity as the temperature rose, though the results were not very regular, owing to unavoidable sources of error.

The results in the following tables are those of a separate set of experiments upon solutions prepared by melting the 10 Aq salt in its water of crystallization, heating the liquid to any determined point, and then quickly decanting off a portion of the fluid, and determining the amount of sulphate of soda contained in it.

100 pts. of water at °C.	Retain in solution (i. e. dissolve) pts. of $Na\,O, S\,O_3 + 10\,Aq$
37.5°	355
50°	324.9
62.5°	305.3
75°	324.9
87.5°	226.32
100°	212.47

Or 1 pt. of the salt is

soluble in	0.2814	pt. of water at	37.5°
"	0.3493	"	50°
"	0.3262	"	62.5°
"	0.3920	"	75°
"	0.4355	"	87.5°
"	0.4706	"	100°

Or, the aqueous solution saturated at °C.	Contains percent of Na O, S O_3 + 10 Aq.
37.5°	78.022
50°	74.108
62.5°	75.402
75°	71.839
87.5°	69.662
100°	67.997

(R. Brandes & Firnhaber, *Brandes's Archiv.*, 1824, **7.** pp. 154 – 173, and fig. of curve; compare *Ibid.*, **13.** 119.)

1 pt. of the anhydrous salt is soluble in pts. of water.	1 pt. of the 10-hydrated salt is soluble in pts. of water.	At °C.	The saturated solution containing of the Anhydrous salt per-cent.	The saturated solution containing of the 10-hydrated salt per-cent.
19.92	8.22	0°	4.78	10.84
9.88	3.79	11.1°	9.19	20.87
	2.08	18°		
	1.00	25°		
	0.37	32°		
1.97	0.31	33°	33.62	76.31
	0.38	50.4°		
2.34		104.4°	20.90	

(Mohr, Redwood, & Procter's *Pharmacy*, and Gmelin's *Handbook.*)

1 pt. of the 10 Aq salt
is soluble in 6.1 pts. of water at 7.5°
" 3.44 " 12.5°
" 2.41 " 18.75°
" 1.724 " 20°
(Karsten, *Vid. Infra.*)

1 pt. of the 10-hydrated salt is soluble in 2.86 pts. of water at a moderate heat, and in 0.8 pt. of boiling water. (Bergman, *Essays,* **1.** 178.) 1 pt. of the 10-hydrated salt is soluble in 3 pts. of water at the ordinary temperature, and in less than 0.5 pt. of water at 33°. (Wittstein's *Handw.*) 1 pt. of the 10-hydrated salt is soluble in 4 pts. of cold, and in 1 pt. of boiling water, the saturated cold solution containing 20% of it. (Fourcroy.) The solution saturated at 12.5° contains 16.1% of it. (Hassenfratz, *Ann. de Chim.*, **28.** 291.) Soluble in 3 pts. of water at 18.75° (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76); in 2.75 pts. of water at 15.6°. [Y.] The aqueous solution saturated at 15° is of 1.10847 sp. gr., and contains dissolved in every 100 pts. of water at least 12.494 pts. of the anhydrous, or 35.492 pts. of the 10 Aq salt. (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.) The 10-hydrated salt begins to melt in its water of crystallization at 33°, and is completely fluid at 37.5°, but a portion of the anhydrous salt immediately separates out. (Berzelius, *Lehrb.*)

100 pts. of
water at 15.5° dissolve 39.4 pts. of the cryst. salt.
" 15.5° " 37 "
" 100° " 80 "
" 100° " 125 "
(Ure's *Dict.*)

100 pts. of water at 15.5° dissolve 48.66 pts. of the crystallized salt. [T.]

Sulphate of soda is much more soluble in warm than in cold water; therefore when a boiling saturated solution of this salt is allowed to cool in an open vessel in contact with the air it deposits a considerable quantity of crystals containing 10 equivalents of water of crystallization. Nevertheless, in certain circumstances, notably when the solution, saturated at its boiling point, is cooled in a vessel hermetically sealed it deposits no crystals at the ordinary temperature of the atmosphere; in this case the water retains in solution a much larger amount of the salt than it could dissolve at that temperature; in this condition the solution is supersaturated. (Lœwel, *Ann. Ch. et Phys.*, (3.) **29.** 63.) Supersaturated solutions may also be obtained by cooling hot solutions of the salt in flasks loosely stopped with cotton wool. (Schrœder, *Ann. Ch. u. Pharm.*, **109.** 45.) Or by covering the vessel containing the hot saturated solution (say of two pts. of the crystallized salt to one pt. of water) with a glass plate, a watch-glass, card, or the like, or by covering the liquid itself with a layer of oil, and then allowing it to cool.

"A hot solution, consisting of equal parts of water and the 10 Aq salt, does not crystallize either on slow cooling or when quickly cooled by immersion in cold water, whether it be contained in a barometer tube freed from air by boiling, or in an exhausted, well-closed vessel, or in an open vessel with a layer of oil of turpentine upon its surface (Gay-Lussac); or in a vessel containing air, either well stopped or merely furnished with a loose cover (Schweigger); or in an open vessel under a bell-jar full of air and closed at the bottom with a water-joint; or in open bottles placed in a quiet situation; or in an open glass enclosed in a stoppered vessel, containing air and some potash to dry it, in which Glauber's salt effloresces and when washed down again does not cause instant crystallization but dissolves. (Ziz.) The crystallization of a solution cooled in this manner is often brought about instantaneously, often, again, after a short time: (1.) By agitation, viz. when the solution has been cooled in an open vessel. (2.) By access of air caused by opening the vessel, the crystallization taking place the more quickly in proportion to the size of the opening; some degree of motion appears also to be necessary. In this case the crystallization begins at the top where the solution, the vessel, and the air come in contact with each other; it is only when a particle of dust falls in on opening the vessel that the crystallization begins a little under the surface. When the solution has been cooled in vacuo, a bubble of air, hydrogen, carbonic acid, or nitrous gas, is sufficient to set up the crystallization. (Gay-Lussac.) (3.) By contact with a solid body (a glass rod, flint, iron wire, crystal of Glauber's salt, or a grain of dust floating in the air). These bodies do not bring about the crystallization when they have been cooled in contact with the hot solution, nor (excepting Glauber's salt) when they are wetted or warmed before contact with the solution. (Ziz.) In these cases crystallization is effected by the action of foreign bodies. If a solution of 8 pts. of Glauber's salt in 9 pts. of water be left to crystallize, the whole then warmed in a flask to between 50° and 55°, till only about $\frac{1}{32}$ of the crystals remain undissolved, and the flask corked up and cooled, it often happens that the remaining crystals, instead of causing the rest to crystallize, are themselves completely dissolved, slowly when the flask is inclined in such a manner as to bring them in contact with the upper strata of the liquid, more quickly on agitation, which, however, is very likely to cause crystallization. If, on the other hand, the solution formed between 50° and 55° be poured off from the crystals into a basin and allowed to crystallize, the mother liquid thus obtained will not dissolve the $\frac{1}{32}$ of the crystals above mentioned. There are, therefore, two solutions to be distinguished, (1.) The *saturated* solution, i. e. the liquid which remains after crystallization of the superabundant quantity of salt, from a hot solution in an open vessel, and, (2.)

The *supersaturated* solution, i. e. the solution saturated at a high temperature and cooled in a close vessel; this latter can even dissolve an additional quantity of salt, but deposits at a lower temperature crystals of sulphate of soda, containing 1 atom of the salt and 8 [7] atoms of water. (H. Ogden.) A solution of 2 pts. of Glauber's salt and 1 pt. of hot water yields, on cooling in close vessels, hard transparent crystals of sulphate of soda, with 8 [7] atoms of water, which, when the supernatant liquid is made to crystallize by any of the preceding methods immediately become opaque. (Coxe; Ziz.) When 51 pts. of Glauber's salt are dissolved in 49 pts. of water, and the solution, after cooling below 10°, made to crystallize suddenly by any of the preceding methods, nearly $\frac{2}{3}$ of the Glauber's salt is deposited, and the temperature rises to 13°. This is attributed by Thomson to the conversion of liquid water into solid water of crystallization, a supposition agreeing pretty well with calculation (the development of heat consequent on the passage of the salt from the liquid to the solid state must, however, be included in the calculation. Gm.). The assertion of Thénard (*Schw.*, **15.** 257), that after this crystallization there remains a mother liquid, which is no longer saturated with salt at the existing temperature, seems to be erroneous. Thomson, on the contrary, finds that the mother liquor, from its rise of temperature, holds in solution a corresponding quantity of salt, a great part of which crystallizes out when the temperature is brought back to 10°." (Gmelin, in his *Handbook*, **1.** pp. 9, 10.)

Citing Gay-Lussac's experiments, Lœwel (*Ann. Ch. et Phys.*, (3.) **49.** 42) remarks, that this experimenter evidently operated upon anhydrous sulphate of soda, which, as Lœwel finds, unites with water to form the 10-hydrated salt so long as the temperature is not elevated above 32°, but which at a temperature of 33° @ 34° dissolves directly as anhydrous salt. Lœwel's own experiments, given in the table below, were upon the crystallized 10-hydrated salt which comports itself as such up to 34°. This explains the differences between Lœwel's table and that of Gay-Lussac.

100 pts. of water at °C.	Retain in solution pts. of the anhydrous salt.
103.17°*	42.65
84.42°	42.96
70.61°	44.35
59.79°	45.42
50.40°	46.82
45.04°	47.81
40.15°	48.78
36°	49.27
34°	49.53
33°	49.71
30°	50.37
26°	51.31
25°	51.53
20°	52.76
18°	53.25

* Boiling point of the saturated solution.

(Lœwel, *Ann. Ch. et Phys.*, (3.) **49.** 39.)

Below 18° a salt of different molecular constitution (7 Aq), and of different solubility is formed.

The saturated aqueous solution of $\mathrm{NaO, SO_3 + 10\,Aq}$ contains for every 100 pts. of water

At °C.	Pts. of anhydrous $\mathrm{NaO, SO_3}$	Pts. of $\mathrm{NaO, SO_3 + 10\,Aq}$
0°	5.02	12.16
10°	9.00	23.04
15°	13.20	35.96
18°	16.80	48.41
20°	19.40	58.35
25°	28.00	98.48
26°	30.00	109.81
30°	40.00	184.09
33°	50.76	323.13
34°	55.00	412.22

At temperatures above 34° the 10 Aq salt is decomposed by water, a salt of other molecular constitution (anhydrous $\mathrm{NaO, SO_3}$), and different degree of solubility being formed. (Lœwel, *Ann. Ch. et Phys.*, (3.) **49.** 42.)

In the solution of $\mathrm{NaO, SO_3 + 7\,Aq}$

Saturated at °C.	100 pts. of water retain in solution pts. of anhyd. $\mathrm{NaO, SO_3}$	pts. of $\mathrm{NaO, SO_3 + 7\,Aq}$
0°	19.62	44.84
10°	30.49	78.90
15°	37.43	105.79
18°	41.63	124.59
20°	44.73	140.01
25°	52.94	188.46
26°	54.97	202.61

At temperatures above 26° the salt with 7 Aq is transformed to the anhydrous salt, for solubility of which see the proper table. (Lœwel, *Ann. Ch. et Phys.*, (3.) **49.** 48.)

In his second memoir upon the subject, Lœwel says that the table of solubility given in his first memoir (*Ann. Ch. et Phys.*, (3.) **29.** 88, § 15) is incorrect, inasmuch as he then calculated the hydrate, which really contains 7 Aq, as if it had 8 Aq, and publishes the following corrected table. [The incorrect table above mentioned has not been copied into this work.]

A saturated solution of the 10 Aq salt contains

At °C.	Anhydr. $\mathrm{NaO, SO_3}$ dissolved by 100 pts. of water.	$\mathrm{NaO, SO_3 + 10\,Aq}$ dissolved by 100 pts. of water.
0°	5.02	12.11
10°	9.3	23.91
13°	11.2	29.6
16°	14.3	39.61
17°	15.6	44.10
18°	16.8	48.41
19°	18.1	53.41
20°	19.5	58.74
103.17°	42.65	210.67

A saturated solution of the 7 Aq salt, enclosed in tight vessels, contains

Anhydr. $\mathrm{NaO, SO_3}$ dissolved by 100 pts. of water.	$\mathrm{NaO, SO_3 + 7\,Aq}$ dissolved by 100 pts. of water.	$\mathrm{NaO, SO_3 + 10\,Aq}$ dissolved by 100 pts. of water.
19.62	44.84	59.23
30.49	78.90	112.73
34.27	92.94	137.48
38.73	111.38	172.6
39.99	117.01	184.01
41.63	124.59	200.00
43.35	132.97	218.34
44.73	140.01	234.4

(Lœwel, *Ann. Ch. et Phys.*, (3.) **33.** 337.)

An aqueous solution of sp. gr. at 19.5° (sp. gr. of water at 19.5° = 1).	Contains Percent of NaO, SO_3.	Pts. of NaO, SO_3 dissolved in 100 pts. of water
1.0262	2.894	2.98
1.0509	5.589	5.92
1.0733	7.995	8.69
1.0977	10.538	11.78
1.1162	12.473	14.25

(Kremers, *Pogg. Ann.*, **95.** 120. The second column is from Gerlach's *Sp. Gew. der Salzlœsungen*, p. 34.)

Sp. gr. (at 15°).	Percent of anhyd. NaO, SO_3.
1.00911	1
1.01822	2
1.02736	3
1.03650	4
1.04575	5
1.05500	6
1.06437	7
1.07375	8
1.08325	9
1.09275	10
1.10246	11
1.11170	11.952*

* Saturated solution.

(Gerlach, *Sp. Gew. der Salzlœsungen*, p. 20: On p. 122 of his work Gerlach gives a table of the sp. grs., and corresponding percentages of sulphate of soda solutions for each degree of temperature between 0° and 20°; and on p. 124 a table of the sp. gr. of a 10% solution at each degree of temperature from 0° to 100°.)

Sp. gr.	Percent of $NaO, SO_3 + 10 Aq$.
1.005	1.262
1.010	2.522
1.015	3.780
1.020	5.035
1.025	6.288
1.030	7.538
1.035	8.786
1.040	10.030
1.045	11.272
1.050	12.510
1.055	13.744
1.060	14.975
1.065	16.203
1.070	17.426
1.075	18.645
1.080	19.860
1.085	21.071
1.090	22.277
1.095	23.478
1.100	24.674

To obtain the corresponding amount of anhydrous salt, multiply any number in this table by $\frac{890 \cdot 0}{2015 \cdot 9}$. (W. Schmidt, *Pogg. Ann.*, 1857, **102.** 132; in *Kopp & Will's J. B.*)

An aqueous solution of sp. gr. (at 19°)	Contains (by experiment) percent of $NaO, SO_3 + 10 Aq$
1.1222	30.01
1.0806	20.01
1.0533	13.34
1.0398	10.00
1.0263	6.66
1.0131	3.33

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108.** 335.) From these results Schiff calculates the following table by means of the formula: $D = 1 + 0.00393 p + 0.0000053 p^2$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 19°).	Percent of $NaO, SO_3 + 10 Aq$.	Of anhydr. NaO, SO_3.
1.0040	1	0.441
1.0079	2	0.882
1.0118	3	1.323
1.0158	4	1.764
1.0198	5	2.205
1.0238	6	2.646
1.0278	7	3.087
1.0318	8	3.528
1.0358	9	3.969
1.0398	10	4.410
1.0439	11	4.851
1.0479	12	5.292
1.0520	13	5.733
1.0560	14	6.174
1.0601	15	6.615
1.0642	16	7.056
1.0683	17	7.497
1.0725	18	7.938
1.0766	19	8.379
1.0807	20	8.820
1.0849	21	9.261
1.0890	22	9.702
1.0931	23	10.143
1.0973	24	10.584
1.1015	25	11.025
1.1057	26	11.466
1.1100	27	11.907
1.1142	28	12.348
1.1184	29	12.789
1.1226	30	13.230

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110.** 70.)

Sp. gr. (at 12.5°).	Percent of sulphate of soda.
1.0039	1
1.0078	2
1.0116	3
1.0154	4
1.0192	5
1.0230	6
1.0268	7
1.0306	8
1.0344	9
1.0381	10
1.0418	11
1.0455	12
1.0492	13
1.0528	14
1.0564	15
1.0598	16

(Hassenfratz, *Ann. de Chim.*, **28.** 296.)

An aqueous solution of sp. gr. (at 12.5°).	Contains for every 100 pts. of water, pts. of $NaO, SO_3 + 10 Aq$.	Boils at °C.
1.005	1	100.5°
1.008	2	100 62°
1.014	3	100.62°
1.020	4	100.75°
1.021	5	100.75°
1.028	6	100.87°
1.030	7	100 87°
1.032	8	101°
1.036	9	101°
1.040	10	101°
1.043	11	101.12°
1.050	12	101.12°
1.055	13	101.25°
1.060	14	101.25°
1.062	15	101.25°
1.064	16	101.25°

An aqueous solution of sp. gr. (at 12.5°).	Contains for every 100 pts. of water, pts. of Na O, S O_3 + 10 Aq.	Boils at °C.
1.067	17	101.25°
1.070	18	101.37°
1.072	19	101.37°
1.074	20	101.37°
1.076	21	101.37°
1.078	22	101.5°
1.080	23	101.5°
1.082	24	101.5°
1.084	25	101.5°
1.090	26	101.5°
1.092	27	101.63°
1.095	28	101.63°
1.098	29	101.63°
1.100	30	101.75°

The most concentrated solution boils at 105.12°. (R. Brandes & Gruner, *Brandes's Archiv.*, 1827, **22.** 148.)

An aqueous solution saturated at 20° is of 1.1259 sp. gr., it contains 36.71% of the 10-hydrated salt, i. e. 100 pts. of water at 20° dissolve 58.02 pts. of the 10-hydrated, or 29 pts. of the anhydrous salt at 20°. (Karsten, *Berlin Abhandl.*, 1840, p. 101.)

Insoluble in alcohol of from 0.817 to 0.90 sp. gr. (Kirwan, *On Mineral Waters*, p. 274 [T.].) 1000 pts. of spirit of 8.872 sp. gr. dissolve 0.7 pt. of Na O, S O_3 at 12.5° @ 15°; and 1000 pts. of spirit, of 0.905 sp. gr., dissolve 3.8 pts. of it at this temperature. Insoluble in alcohol of from 0.83 to 0.85 sp. gr. (Anthon, from *Buchner's Repert.*, **2.** pp. 13, 18; in *J. pr. Ch.*, **14.** 125.) Very sparingly soluble in absolute alcohol at ordinary temperatures; somewhat more, though still exceedingly sparingly, soluble in absolute alcohol acidulated with sulphuric acid. (Fresenius, *Quant.*, pp. 121, 751.) The 10 Aq salt is unacted upon by alcohol at the ordinary temperature, its water of crystallization remaining unchanged. The 10 Aq is also precipitated by alcohol from a solution of sulphate of soda saturated at 37.5°. On the other hand, when the 10 Aq salt is mixed with two pts. of alcohol, and then heated to 37.5°, the salt which separates out contains only 32 5% of water, while on heating to 37.5°, without the addition of alcohol, the separated salt contains 42.65% of water; in like manner, on heating a mixture of the 10 Aq salt and alcohol to 62.5° @ 68.75°, the salt which separates out contains 22% of water, which is as little as is contained in the salt separating when the 10 Aq salt is heated by itself to 87.5°. (Brandes & Firnhaber, *Brandes's Archiv.*, 1824, **7.** 170.) When a certain amount of alcohol is added to an aqueous solution of sulphate of soda, a concentrated aqueous solution of the latter is thrown down; but when a larger quantity of alcohol is employed crystals separate. (Ordway, *Am. J. Sci.*, (2.) **33.** 35.)

A solution (saturated at 15°) sp. gr.	in alcohol of percent by weight.	Contains percent of Na O, S O_3 + 10 Aq
1.000	0	25.6
0 896	10	14.35
0.972	20	5.6
0.939	40	1.3

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118.** 365.)

Alcohol precipitates it from the cold saturated aqueous solution.

Soluble in glycerin. (Pelouze.) Soluble, with decomposition in chlorhydric acid. Sulphate of soda crystallizes unchanged from its solution in acetic acid. (Persoz, *Chim. Moléc.*, p. 348.)

Difficultly soluble in strong acetic acid. (Ure's *Dict. Arts.*) Glacial acetic acid produces no precipitate when added to an aqueous solution of sulphate of soda. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 443.)

More soluble in aqueous solutions of various salts, as the sulphates of potash, copper, and magnesia, than in pure water. (Pfaff, *Ann. Ch. u. Pharm.*, **99.** 226. Compare Pagenstecher, *J. pr. Ch.*, **42.** 137.) Soluble in saturated solutions of the sulphates of magnesia, potash, and copper, but if more sulphate of soda (effloresced) than can be dissolved is added to the last-named solution, a large quantity of the double salt Na O, S O_3; Cu O, S O_3 is suddenly deposited. (Karsten, *Berlin Abhandl.*, 1840, p. 121.) Slowly but somewhat abundantly soluble in a saturated solution of sulphate of zinc. After several days, crystals of a double salt separate from this solution. (Karsten, *loc. cit.*, p. 124.)

Soluble in a saturated solution of chloride of ammonium, also rapidly and in considerable quantity in a saturated solution of chloride of potassium, with separation of sulphate of potash. (Karsten, *loc. cit.*, pp. 121, 131.)

Crystallized (10-hydrated) sulphate of soda is soluble in a saturated solution of chloride of sodium without causing any precipitation of the latter. If the effloresced sulphate be used, however, it occasions, while dissolving, a precipitation of Na Cl at first, and subsequently of Na O, S O_3 + 10 Aq. A solution of the same sp. gr. as the above is obtained when an excess of a mixture of Na O, S O_3 and Na Cl is treated with water at the same temperature. (Karsten, *loc. cit.*, p. 114.) Soluble in a boiling saturated solution of chloride of sodium, while the latter is precipitated. From cold solutions, however, the sulphate of soda separates before the chloride of sodium. (Vauquelin, *Ann. de Chim.*, **13.** 98.) Less soluble in an aqueous solution of chloride of sodium than in pure water. (T. S. Hunt, *Am. J. Sci.*, (2.) **25.** 368.)

Soluble in a saturated solution of nitrate of potash, without occasioning any precipitation until after the lapse of several hours, when some sulphate of potash separates. (Karsten, *loc. cit.*, p. 129.)

Crystallized (10-hydrated) sulphate of soda is soluble in a saturated solution of nitrate of soda, without causing any precipitation of the latter. If, however, effloresced sulphate of soda be employed, a portion of nitrate of soda is precipitated at first, but subsequently this is redissolved, and Na O, S O_3 + 7 Aq is deposited. (Karsten, *loc. cit.*, p. 115.)

Soluble in a saturated aqueous solution of nitrate of ammonia, from which solution it is not displaced by salts which would precipitate it from a solution in pure water. (Margueritte, *C. R.*, **38.** 307.)

When one equivalent of Na O, S O_3, in aqueous solution, is mixed with a solution of an equivalent of acetate of potash (C_4 H_3 K O_4) $\frac{62}{100}$ of it are decomposed to sulphate of potash, which may be precipitated by adding alcohol, while $\frac{88}{100}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of zinc (Zn Cl) $\frac{29}{100}$ of it are decomposed as before, while $\frac{71}{100}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of magnesium (Mg Cl) $\frac{458}{1000}$ of it are decomposed while $\frac{542}{1000}$ of it remain unchanged. (Malaguti, *Ann. Ch. et Phys.*, 1853, (3.) **37.** 203.)

II.) *Sesqui*SULPHATE OF SODA. Not efflorescent. 100 pts. of water at 17.2° dissolve about 25 pts. of it. Insoluble in alcohol. (T. Thomson, in his *System of Chem.*, London, 1831, **2.** 446.)

$2NaO, 3SO_3$

III.) *Bi*SULPHATE OF SODA.

$a = NaO, HO, 2SO_3 \& + 2Aq$ Deliquescent. Soluble in 2 pts. of water at 0° (Link); and in 1 pt. of boiling water. (Schubarth, *Tech. Chem.*) 100 pts. of water at 15.5° dissolve 92.72 pts. of it. [T.] Soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.)

Decomposed by water, and alcohol. On dissolving the salt in 4 pts. of water, and leaving the solution to itself, the normal salt (I.) crystallized out. The bisalt melts more difficultly and becomes less fluid than the normal (10 Aq) salt when heated. (R. Brandes & Firnhaber, *Brandes's Archiv.*, 1824, **7.** pp. 173 – 180.) When the aqueous solution is allowed to evaporate spontaneously it often happens that it is decomposed, the monosulphate crystallizing out. (Arrott, *Phil. Mag.*, 1844, (3.) **24.** 503.)

More readily decomposed by water than the corresponding potash salt; being even decomposed by the moisture of the air, which it gradually absorbs; this is not the case with the potash salt. (Heumann; Wittstein; H. Rose, *Pogg. Ann.*, **82.** 554.)

SULPHATE OF SODA & *of sesquioxide* OF URANIUM. Soluble in water.

SULPHATE OF SODA & OF ZINC.

I.) Deliquesces in moist air. Soluble, with decomposition, in water. (Graham.)

II.) Permanent. Soluble in water. The aqueous solution is not decomposed at 100°; when evaporated at 55° the double salt crystallizes out as such, but when it is allowed to evaporate spontaneously the component salts crystallize out separately. (Arrott.)

$NaO, SO_3; ZnO, SO_3 + 4Aq$

SULPHATE OF SODA & OF ZIRCONIA. Soluble in water.

SULPHATE OF SOLANIN. Readily soluble in water. The solution is decomposed by ebullition, an acid salt separating out.

SULPHATE OF SPARTEIN. Exceedingly soluble in water. (Stenhouse.)

SULPHATE OF STANNAMYL. Insoluble in water or ether. Sparingly soluble in alcohol.

$C_{10}H_{11}SnO, SO_3$

SULPHATE OF *bi*STANNAMYL. Soluble in alcohol, and ether.

SULPHATE OF $\frac{2}{2}$ STANNAMYL. Readily soluble in alcohol, from which it is precipitated on the addition of water.

$(C_{10}H_{11})_2Sn_2 . O, SO_3$

SULPHATE OF $\frac{3}{2}$ STANNAMYL. Easily soluble in alcohol, and ether; water precipitates it from these solutions.

$(C_{10}H_{11})_3, Sn_2 . O, SO_3$

SULPHATE OF $\frac{4}{2}$ STANNAMYL.

SULPHATE OF STANN(*ous*)ETHYL. Soluble in water, and alcohol.

C_4H_5SnO, SO_3

SULPHATE OF *di*STANN*tri*ETHYL. Permanent. Very sparingly soluble in water. Readily soluble in alcohol. Much more soluble in *cold* than in hot water, a clear, cold saturated solution becoming semisolid when heated nearly to the boiling point. (Buckton.)

$(C_4H_5)_3Sn_2O, SO_3$

SULPHATE OF *tetra*STANN*pent*ETHYL. Nearly insoluble in water; and less soluble in alcohol than distanntriethyl.

$(C_4H_5)_5Sn_4O, SO_3$

SULPHATE OF STANNMETHYL.

C_2H_3SnO, SO_3

SULPHATE OF STIB*di*AMYL. Insoluble in water, or dilute alcohol. Easily soluble in absolute alcohol. Very difficultly soluble in ether.

SULPHATE OF STIB*tri*AMYL. Soluble in alcohol. It resembles the nitrate. (Berlé.)

$Sb\left\{(C_{10}H_{11})_3O_2, 2SO_3\right.$

SULPHATE OF STIB*tri*ETHYL.

I.) *normal.* Very deliquescent. Easily soluble in water. (Merck.)

$Sb\left\{(C_4H_5)_3 . O_2, HO, SO_3\right.$

II.) *acid.* Exceedingly easily soluble in water. Tolerably easily soluble in alcohol. Nearly insoluble in ether. (Lœwig & Schweizer.)

$Sb\left\{(C_4H_5)_3O_2, 2SO_3\right.$

SULPHATE OF STIBETHYLIUM. Exceedingly deliquescent. Soluble in water.

$Sb\left\{(C_4H_5)_4O, SO_3\right.$

SULPHATE OF STIB*tri*METHYL.

$Sb\left\{(C_2H_3)_3 . O_2, HO, SO_3\right.$

SULPHATE OF STIBMETHYL*tri*ETHYLIUM. Extremely deliquescent. Soluble in water. (Friedlænder.)

$Sb\left\{\begin{matrix}(C_2H_3)\\(C_4H_5)_3\end{matrix}\right. . O, SO_3$

SULPHATE OF STIBMETHYLIUM.

I.) *normal.* Permanent. Very soluble in water, and alcohol. Insoluble in ether.

$Sb\left\{(C_2H_3)_4O, SO_3 + 5Aq\right.$

II.) *acid.* Easily soluble in water; more difficultly soluble in alcohol. Almost insoluble in ether.

$Sb\left\{(C_2H_3)_4O, HO, 2SO_3\right.$

SULPHATE OF STRONTIA. Permanent. Soluble in 5345 pts. of water at 15° (Kremers, *Pogg. Ann.*, **85.** 247); in 3600 pts. of water at 15.5° [*Gm.*]; in 3600 pts. of boiling water, and remains dissolved as the solution cools. (Berzelius's *Lehrb.*) Soluble in 15029* pts. of water at 11.25°, and in 3544* pts. of boiling water. (R. Brandes & Silber, *Brandes's Archiv.*, 1830, **33.** 61.) Soluble in 3840 pts. of boiling water. (Moretti, cited by Brandes & Silber, *loc. cit.*)

SrO, SO_3

Soluble in 6895 pts. of water at 14°, and in 9638 pts. at 100°. Less soluble in water containing some sulphuric and chlorhydric acids; requiring 11016 @ 11780 pts. of the liquid to dissolve it. In a solution containing a considerable excess of sulphuric acid 12791 pts. were required to dissolve 1 pt. of sulphate of strontia. As a mean, the number 11862 may represent the amount of liquid containing mixed chlorhydric and sulphuric acids [such as would occur in ordinary processes of analysis], which is required to dissolve 1 pt. of the salt. (Fresenius. *Ann. Ch. u. Pharm.*, 1846, **59.** 121.) It is, however, much more soluble in liquors somewhat more strongly acidulated than those just alluded to. Thus, when recently precipitated SrO, SO_3 is digested during 2 days in cold dilute nitric acid (of 4.8%) 1 pt. of it dissolves

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[* These numbers, given in the original article, do not agree with the statement of the details of the experiments, which indicate a solubility of one pt. SrO, SO_3 in 25696 pts. of water at 11 25°, and in 3623 pts. of water at boiling.]

in from 429 @ 435 pts. of the acid (mean = 1 : 432). When digested during 2 days in cold dilute chlorhydric acid (of 8.5%), 1 pt. of it dissolves in from 472 @ 474 pts. of the acid. When digested during 2 days in cold dilute acetic acid (of 15.6% hydrated acid), 1 pt. of it dissolved in 7843 pts. of the acid. (Fresenius, *Ann. Ch. u. Pharm.*, 1858, **106.** 220, also *Quant.*, p. 754.) When left in contact with chlorhydric acid during several hours at the ordinary temperature of the air a portion of it dissolves. In the solution thus obtained dilute sulphuric acid, as well as chloride of strontium, produces a precipitate; that produced by the former being somewhat more distinct than the latter. If the sulphate of strontia be boiled with the chlorhydric acid the solution will be more rapid. (H. Rose, *Pogg. Ann.*, **25.** 109.)

Sensibly more soluble in water than carbonate of strontia. (Dulong, *Ann. de Chim.*, **82.** 290.) Almost absolutely insoluble either in absolute alcohol or in dilute spirit. (Fresenius, *Quant.*)

Slowly but completely soluble in an aqueous solution of chloride of sodium, from which it is reprecipitated when dilute sulphuric acid is added. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.) Less freely soluble in an aqueous solution of sulphate of soda than in pure water, and still less soluble in water acidulated with sulphuric acid. (Andrews, *Phil. Mag.*, (4.) **7.** 406.) Completely insoluble in a concentrated aqueous solution of sulphate of ammonia (1 pt. salt to 4 pts. of water), or any other alkaline sulphate. (H. Rose.) It is not precipitated from solutions containing neutral citrates. (Spiller, *J. Ch. Soc.*, **10.** 110.) Like sulphate of baryta, its precipitation is much hindered by the presence of metaphosphate of soda. (Rube, *J. pr. Ch.*, 1858, **75.** 116.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.)

Sulphate of strontia is completely decomposed, even at the ordinary temperature, and more rapidly on boiling, by aqueous solutions of mono or bicarbonate of potash, soda, or ammonia, even when considerable quantities of the alkaline sulphates are present. (H. Rose.) When an equivalent of $Sr\,O, S\,O_3$ is boiled with one of $2\,Na\,O, H\,O, P\,O_5$, in aqueous solution, $\frac{45}{100}$ of it may be decomposed. (Malaguti, *Ann. Ch. et Phys.*, (3.) **51.** 335.) Soluble in concentrated sulphuric acid, especially when this is hot, but is precipitated from this solution on the addition of water. (Hope.)

SULPHATE OF STRYCHNINE.

I.) *normal.*
$N_2\left\{C_{42}H_{22}O_4^{VI}\right.. H\,O, S\,O_3 + 7\,Aq$
Soluble in 42 pts. of cold, and in 1 pt. of boiling water; in 82 pts. of cold, and in 1 pt. of boiling alcohol. (Wittstein's *Handw.*) Soluble in less than 10 pts. of cold, and more soluble in warm water. (Gerhardt's *Traité.*)

"Sulphate of strychnine" is soluble in about 50 pts. of water at 22° (Bouchardat, *Ann. Ch. et Phys.*, (3.) **9.** 229); in 48 pts. of water at 18.75°. (Ahl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)

II.) *acid.* Soluble in dilute sulphuric acid.
$N_2\left\{C_{42}H_{22}O_4^{VI}\right.. H\,O, H\,O, 2\,S\,O_3$

SULPHATE OF TELLURETHYL. Easily soluble in water.
$\left.\begin{matrix}C_4\,H_5\,Te\\C_4\,H_5\,Te\end{matrix}\right\}O_2, H\,O, S\,O_3$

SULPHATE *of binoxide* OF TELLURIUM.

I.) *basic.* Decomposed by water. Soluble in warm chlorhydric or nitric acid. (Fischer.)

II.) *normal*, or *bi*.
$Te\,O_2, 2\,S\,O_3$
Decomposed by water. Soluble in warm chlorhydric and nitric acids, crystallizing out again as the solution cools. (Magnus, cited in Wittstein's *Handw.*)

SULPHATE OF TELLURMETHYL.
$C_2\,H_3\,Te\,O, S\,O_3$
Easily soluble in water. Insoluble in alcohol. (Wœhler & Dean, *Ann. Ch. u. Pharm.*, **93.** 235.)

SULPHATE OF THEBAIN.

SULPHATE OF THIACETONIN. Sparingly soluble in water. Insoluble in alcohol. (Stædeler.)

SULPHATE OF THORIA.

I.) *normal.*

a = *anhydrous.*
$Th\,O, S\,O_3$

b = $Th\,O, S\,O_3 + 2\,Aq$ Separates out from dilute solutions of the hydrates *c* and *b* when these are boiled, and from concentrated solutions when these are evaporated at temperatures above 25°.

Slowly soluble in cold water, and with especial difficulty if but little of the latter is present. Very difficultly soluble in hot water. (Berzelius, *Pogg. Ann.*, 1829, **16.** 407.)

It is so much the less soluble in water in proportion as the temperature of this approaches the boiling point, being scarcely at all soluble in boiling water. That which has separated from a hot solution redissolves as the solution cools. When crystallized it is completely, though very slowly, soluble in cold water, dissolving more rapidly when a large excess of water is present, but months are required if one wishes to obtain a saturated solution. (Berzelius's *Lehrb.*, **3.** 514; **2.** pp. 191, 193.)

c = $Th\,O, S\,O_3 + 5\,Aq$ Permanent. Like sulphate of yttria, this salt dissolves so slowly in water that crystals of it may remain therein for a long time without losing the sharpness of their angles. When powdered it dissolves more easily, water finally taking up a great deal of it. Decomposed by boiling water, with formation of the hydrate *b*. When the aqueous solution is heated, or evaporated at temperatures superior to 25°, it is decomposed, the hydrate *b* separating out.

Sulphate of thoria is insoluble in alcohol, by which it may be precipitated from the aqueous solution. From a cold aqueous solution alcohol precipitates the 5 Aq salt (*c*), but from hot solutions only the 2 Aq salt (*b*) is obtained. (Berzelius, *Pogg. Ann.*, 1829, **16.** pp. 406 – 408.)

II.) *acid.*
$Th\,O, 2\,S\,O_3$?
Quickly and completely soluble in cold water, but when this solution is evaporated the normal salt separates out, leaving an acid mother liquor. (Berzelius.) When treated with an excess of cold water it dissolves immediately, but if so small an amount of water be added that the salt becomes heated thereby it dissolves very much more slowly. (Berzelius, *Pogg. Ann.*, 1829, **16.** pp. 406, 409.)

III.) *basic.* When a solution of the normal sulphate is treated with successive small portions of ammonia basic salts are precipitated; at first these precipitates redissolve, but as they become more basic they are insoluble in water. (Berzelius, *Pogg. Ann.*, 1829, **16.** 409.)

SULPHATE *of protoxide* OF TIN.

I.) *mono.*
$Sn\,O, S\,O_3$
Very soluble in water, but the solution soon deposits a basic salt. (Bouquet.)

II.) *basic.* Insoluble, or very sparingly soluble, in water. Soluble in dilute sulphuric acid.

Sulphate *of binoxide* of Tin (*α*, or of Stannic Acid).

I.) *ordinary.* $Sn\,O_2, 2\,S\,O_3$ Soluble in water. The aqueous solution is decomposed by boiling. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 481.) The solution in water acidulated with sulphuric acid yields no precipitate on boiling. (Fremy.) Soluble in a small quantity of water, if left in contact therewith for some time. When a solution of bichloride of tin is diluted with a large quantity of water, and then treated with sulphuric acid, sulphate of tin is precipitated. The sulphuric acid may be separated from this precipitate by washing with a large quantity of water. The precipitate is soluble in chlorhydric acid, if not immediately, at least after a time. (H. Rose, *Tr.*)

II.) *anomalous* (*β*, *or Sulphate of MetaStannic Acid*). Very soluble in water, and alcohol. The aqueous solution is decomposed by boiling. (Fremy, *Ann. Ch. et Phys.*, (3.) **12.** 474.)

Sulphate *of sesquioxide* of Titanium. Deliquescent. Very soluble in water. The aqueous solution is decomposed on ebullition. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **20.** 393.) Dilute sulphuric acid produces an abundant precipitate of sulphate of tin in a chlorhydric acid solution of oxide of tin (modif. *β*). On washing the precipitate with water the sulphuric acid may all be removed, especially if the water is warm. (H. Rose, *Tr.*)

Sulphate *of binoxide* of Titanium.

I.) $9\,Ti\,O, S\,O_3 + 9\,Aq$ Insoluble in water or alcohol. (H. Rose.)

II.) *normal.* $Ti\,O_2, 2\,S\,O_3$ Completely soluble in a small quantity of lukewarm water; but this solution becomes turbid when more water is added, and when the dilute aqueous solution is boiled all the titanic acid is precipitated. Decomposed by alcohol. (H. Rose.)

Sulphate of Toluenyl.

I.) *normal.* (*Sulphanisolid.*) $C_{14}\,H_7\,O, S\,O_3$ Insoluble in water. Readily soluble in alcohol, and ether. Soluble, with combination, in concentrated sulphuric acid. (Cahours, *Ann. Ch. et Phys.*, (3.) **27.** 461.)

II.) *acid.* (*SulphAnisolic Acid*) $C_{14}\,H_7\,O, H\,O, 2\,S\,O_3$ Known only in solution. Its compounds with the metallic oxides are soluble in water.

Sulphate of Toluidin (or of Toluenylamin). $N\left\{\begin{matrix}C_{14}\,H_7\\H_2\end{matrix}\right. .\,H\,O, S\,O_3$ Readily soluble in water. Sparingly soluble in alcohol. Very sparingly soluble, or insoluble, in ether. (Muspratt & Hofmann.)

Sulphate of Tungstic Acid. Soluble in pure water, from which solution it is precipitated on the addition of nitric or sulphuric acid.

Sulphate of Tyrosin. $C_{18}\,H_{10}\,N\,O_5, 2\,H\,O, S_2\,O_6 + Aq$ Easily soluble in water, but the solution soon decomposes.

Sulphate *of protoxide* of Uranium.

I.) *mono.*

$a =$ Soluble in water. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 33.) Insoluble in alcohol. (Berzelius's *Lehrb.*) Alcohol precipitates a basic salt from the acidulated aqueous solution. (Berzelius's *Lehrb.*)

$b = Ur\,O, S\,O_3 + 2\,Aq$ Permanent. Decomposed by water, with formation of an insoluble disalt. Soluble in dilute sulphuric acid, and very easily in dilute chlorhydric acid, but is very sparingly soluble in concentrated acids. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 215.)

$c = Ur\,O, S\,O_3 + 4\,Aq$ Permanent. (Rammelsberg.) Decomposed by water, with formation of a difficultly soluble basic salt. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** 33.)

II.) *di.* $2\,Ur\,O, S\,O_3 + 2\,Aq$ Insoluble in water. When treated with large quantities of water, and especially if this be hot, sulphuric acid is abstracted from it. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 217.)

Sulphate *of sesquioxide* of Uranium.

I.) *mono.* $Ur_2\,O_3, S\,O_3 + 3\,Aq$ Slightly efflorescent. Easily soluble in water, and alcohol. (Berzelius.) The crystallized salt is soluble in 0.465 pt. of water at 22°, and in 0.289 @ 0.273 pt. of boiling water. Or 100 pts. of water at 22° dissolve 215 pts. of it, and 100 pts. of boiling water dissolve 346 @ 364 pts. of it. Soluble in alcohol. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 210.) Soluble in 0.6 pt. of cold, and in 0.45 pt. of boiling water (Bucholz); soluble in 4 @ 5 pts. of cold, and in 3 pts. of boiling water. (Wittstein's *Handw.*) 100 pts. of water at 15.5° dissolve 160 pts. of it, and at 100°, 220 pts. (Ure's *Dict.*)

Sulphate of uranium may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch et Phys.*, 1836, (2.) **63.** 444.) Soluble in 25 pts. of cold, and in 20 pts. of boiling alcohol. (Bucholz.)

II.) *bi.* $Ur_2\,O_3, 2\,S\,O_3 + Aq$ Deliquescent. Very soluble in water. (Péligot, *Ann. Ch. et Phys.*, (3.) **12.** 559.)

III.) *ter.* $Ur_2\,O_3, 3\,S\,O_3$ Péligot doubts the existence of a tersulphate. Deliquescent. Soluble in water, but is decomposed thereby, the bisalt separating out when the solution is evaporated. (Berzelius, *Lehrb.*, **3.** 1107.)

IV.) *polybasic.* $3\,Ur_2\,O_3, S\,O_3$ When ammonia is added to an aqueous solution of the sulphate, $Ur_2\,O_3, S\,O_3$, the precipitate, at first formed, continues to redissolve till half the acid is neutralized. The clear liquid thus obtained becomes milky after a while, and finally deposits a whitish sediment, but this is exceedingly small in amount. But if, instead of ammonia, the monosulphate be treated with an excess of carbonate of baryta two thirds of its acid may be removed. The solution of terbasic salt thus obtained may be boiled without change, and the residue obtained by evaporating it to dryness redissolves completely in water. (Ordway, *Am. J. Sci.*, 1858, (2.) **26.** pp. 208, 209.)

Sulphate *of protoxide & of sesquioxide* of Uranium. $Ur\,O, S\,O_3;\ Ur_2\,O_3, S\,O_3$ Soluble in water. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 213.) Soluble in water. When the aqueous solution is boiled basic sulphate of protoxide of uranium separates out, but dissolves again as the solution cools. Alcohol precipitates all the salt of the protoxide, as a basic salt, when added to the aqueous solution. (Berzelius, *Lehrb.*)

Sulphate of Urea. $C_2\,H_4\,N_2\,O_2, H\,O, S\,O_3$ Soluble in water, and alcohol. (Cap & Henry.)

Sulphate of Uric Acid. $C_{10}\,H_4\,N_4\,O_6, 6\,(H\,O, S\,O_3)$ Exceeding hygroscopic, with decomposition. Soluble in warm concentrated sulphuric acid, separating out as the solution cools. (Fritzsche.)

SULPHATE *of binoxide* OF VANADIUM.

I.) *normal.* Deliquesces more readily in warm $VO_2, 2SO_3 + 4Aq$ moist air than it dissolves in water at 10°. Very slowly soluble in water at 10°, but rapidly soluble in water at 60°, and still more quickly in boiling water. Very imperfectly soluble in absolute alcohol; easily soluble in alcohol of 0.833 sp. gr. (Berzelius)

II.) *basic.* Soluble in water.

SULPHATE OF VANADIC ACID.

I.) *basic.* Insoluble in hot water.

II.) *bi.* Deliquescent. Soluble in water. (Ber- $VO_3, 2SO_3$ zelius.)

III.) *ter*, or *normal.* Very deliquescent. Solu- $VO_3, 3SO_3$ uble in water, and alcohol. On boiling the aqueous solution it is decomposed to the basic and the peracid salt.

IV.) *peracid.* Soluble in water.

SULPHATE OF VERATRIN. Soluble in water.
$N_2 \} C_{64}H_{52}O_{16}^{VI} . HO, SO_3$

SULPHATE OF *tetra*VINYLIUM.

I.) *normal.* Permanent. Soluble in water. $NC_{16}H_{12}O, SO_3$ Sparingly soluble in alcohol.

II.) *acid.* Soluble in water.
$2NC_{16}H_{12}O, HO, 2SO_3$

SULPHATE OF XANTHOCOBALT. Rather sol- $NO_2 . 5NH_3 . Co_2O_3, 2SO_3 + Aq$ uble in hot, much less soluble in cold water. Soluble, without decomposition, in a cold aqueous solution of sulphurous acid; this solution is decomposed on boiling. (Gibbs & Genth, *Smithson. Contrib.*, vol. **9.**)

SULPHATE OF XYLIDIN. Sparingly soluble in $N \left\{ \begin{matrix} C_{16}H_9 \\ H_2 \end{matrix} \right. . H\dot{O}, S\dot{O}_3$ cold, more soluble in hot water. (Church.)

SULPHATE OF YTTRIA.

I.) *mono.* Permanent. Effloresces at 40°. Very YO, SO_3 slowly soluble in 25 @ 30 pts. of water (Klaproth); in 50 pts. of cold, and is not much more soluble in hot water. (Vauquelin.) 100 pts. of water dissolve 8 pts. of it at 18.3°. Insoluble in alcohol. (Steele, ?, in Thomson's *System of Chem.*, London, 1831, **2.** 551.)

This salt is characterized by the extraordinary slowness with which it dissolves in water, even when this is warm: it even appears at first sight as if it were completely insoluble, but it gradually dissolves completely. The saturated solution contains from $\frac{1}{45}$ @ $\frac{1}{30}$ of its weight of the salt. In presence of an excess of acid it is less easily soluble in water, and crystallizes more readily. (Berzelius, *Lehrb.*, **3.** 499.) Much less soluble in water than the nitrate of yttria.

Sulphate of yttria may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63.** 444.)

II.) *tri.* Insoluble in water. Soluble in acids.
$3YO, SO_3$

SULPHATE OF ZINC.

I.) *normal.*

a = *anhydrous.* Soluble in water, with evolu- ZnO, SO_3 tion of heat. (Graham.) Soluble in chlorhydric acid. (Kane.)

$b = ZnO, SO_3 + Aq$

$c = ZnO, SO_3 + 2Aq$ Insoluble in alcohol. (Kuehn.) This hydrate is precipitated when strong sulphuric acid is mixed with a concentrated aqueous solution of *g*.

$d = ZnO, SO_3 + 3Aq$ This salt is deposited from very concentrated solutions of the 7-hydrated salt; it is less soluble than the latter in water. (T. Thomson's *System of Chem.*, London, 1831, **2.** 611.)

$e = ZnO, SO_3 + 5Aq$ Insoluble in boiling alcohol of 0.86%. (Kuehn.)

$f = ZnO, SO_3 + 6Aq$ Separates from the aqueous solution when this is evaporated at temperatures above 30°. (Mitscherlich.)

$g = ZnO, SO_3 + 7Aq$ Efflorescent.
The ordinary crystallized salt.
(Zinc Vitriol. White Vitriol.)

100 pts. of water at °C.	Dissolve pts. Of the anhydr. salt.	Dissolve pts. Of the 7-hydrated salt.
0°	43.02	115.22
10°	48.36	138.21
20°	53.13	161.49
30°	58.40	190 90
40°	63.52	224.05
50°	68.75	263.84
60°	74.20	313.48
70°	79.25	369.36
80°	84.60	442.62
90°	89.78	533.02
100°	95.03	653.59

(Poggiale, *Ann. Ch. et Phys.*, (3.) **8.** 467.)

0°	41.3
20°	53.0
25°	54.6
50°	66.9
75°	80.4

(Tobler, *Ann. Ch. u. Pharm.*, **95.** 198, and fig.)

Soluble in 0.61 pt. of water at 20.5°; or 100 pts. of water at 20.5° dissolve 163.2 pts. of it; or the aqueous solution saturated at 20.5° contains 62.1% of it, or 34.8% of the anhydrous salt. and is of 1.4650 sp. gr. (H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **109.** 326.) Soluble in somewhat more than 2 pts. of water [at the ordinary temperature], but much more readily soluble in boiling water. (Bergman, *Essays*, **1.** 184.) 100 pts. of the saturated aqueous solution contain at the boiling point (104.4°) 45 pts. of the dry salt; or 100 pts. of water at 104.4° dissolve 81.81 pts. of it; or 1 pt. of the salt is soluble in 1.2222 pts. of water at 104.4°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) The aqueous solution saturated at 17.5° is of 1.4353 sp. gr., and contains 51.98% of the salt; i. e. 100 pts. of water at 17.5° dissolve 108.26 pts. of the hydrated salt, or 1 pt. thereof is soluble in 0.923 pt. of water at 17.5. (Karsten, *Berlin Abhandl.*, 1840, p. 101.) At ordinary temperatures 100 pts. of water dissolve 140 pts. of the 7-hydrated salt. (Dumas, *Tr.*) Soluble in 2.3 pts. of cold, and in less than 1 pt. of hot water. Soluble in 2.29 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.) 100 pts. of water at 15.56° dissolve 140 pts. of it (Ure's *Dict.*); 93.88 pts. of the 7 Aq salt. [T.] The aqueous solution saturated at 10° contains 36% of it (Eller); and at 12.5°, 55.5%. (Hassenfratz, *Ann. de Chim.*, **28.** 291.) The aqueous solution saturated at 15° is of 1 444244 sp. gr., and contains dissolved in every 100 pts. of water at least 140.526 pts. of "sulphate of zinc." (Michel & Krafft, *Ann. Ch. et Phys.*, (3.) **41.** pp. 478, 482.)

Sulphate of zinc is liable to form supersaturated solutions. (Ogden.) When heated it melts in its water of crystallization. The aqueous solution saturated at 8° is of 1.421 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24**. 210.)

An aqueous solution of sp. gr. at 20.5°.	Contains (by experiment) percent of Zn O, S O_3 + 7 Aq.
1.4650	62.12
1.2790	41.41
1.1740	27.61
1.1271	20.70
1.0817	13.80
1.0397	6.90

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **108**. 336.)

From these results Schiff calculates the following table by means of the formula: $D = 1 + .005681\ p + 0.00001812\ p^2 + 0.0000001748\ p^3$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution.

Sp. gr. (at 20.5°).	Percent of Zn O, S O_3 + 7 Aq	Of andr. Zn O, S O_3.
1.0057	1	0.56
1.0115	2	1.12
1.0173	3	1.68
1.0231	4	2.24
1.0289	5	2.80
1.0348	6	3.36
1.0407	7	3.92
1.0467	8	4.48
1.0527	9	5.04
1.0588	10	5.60
1.0649	11	6.16
1.0710	12	6.72
1.0772	13	7.28
1.0835	14	7.84
1.0899	15	8.40
1.0962	16	8.96
1.1026	17	9.52
1.1091	18	10.08
1.1156	19	10.64
1.1222	20	11.20
1.1288	21	11.76
1.1355	22	12.32
1.1423	23	12.88
1.1491	24	13.44
1.1560	25	14.00
1.1629	26	14.56
1.1699	27	15.12
1.1770	28	15.68
1.1842	29	16.24
1.1914	30	16.80
1.1987	31	17.36
1.2060	32	17.92
1.2134	33	18.48
1.2209	34	19.04
1.2285	35	19.60
1.2362	36	20.16
1.2439	37	20.72
1.2517	38	21.28
1.2595	39	21.84
1.2674	40	22.40
1.2754	41	22.96
1.2834	42	23.52
1.2917	43	24.08
1.3000	44	24.64
1.3083	45	25.20
1.3167	46	25.76
1.3252	47	26.32
1.3338	48	26.88
1.3424	49	27.44
1.3511	50	28.00
1.3599	51	28.56
1.3688	52	29.12
1.3779	53	29.68
1.3871	54	30.24
1.3964	55	30.80
1.4057	56	31.36
1.4151	57	31.92
1.4246	58	32.48
1.4342	59	33.04
1.4439	60	33.60

(H. Schiff, *Ann. Ch. u. Pharm.*, 1859, **110**. 72.)

A solution of sp. gr. (at 12.5°).	Contains per-cent of sulphate of zinc.	A solution of sp. gr. (at 12.5°).	Contains per-cent of sulphate of zinc.
1.0080	2	1.1550	28
1.0165	4	1.1680	30
1.0255	6	1.1820	32
1.0345	8	1.1960	34
1.0440	10	1.2100	36
1.0540	12	1.2240	38
1.0665	14	1.2380	40
1.0790	16	1.2525	42
1.0915	18	1.2680	44
1.1040	20	1.2855	46
1.1165	22	1.3045	48
1.1290	24	1.3310	50
1.1420	26	1.3485	52
		1.3565	54

(Hassenfratz, *Ann. de Chim.*, **28**. 297.)

Hot alcohol, even absolute, dissolves a trace of it. (Kuehn.) Sulphate of zinc is insoluble in spirit, the sp. gr. of which = 0.880. 1000 pts. of spirit of 0.905 sp. gr. dissolve 2 pts. of it. (Anthon, from *Buchner's Repert.*, II. pp. 13, 18; in *J. pr. Ch.*, **14**. 125.)

A solution (saturated at 15°) in alcohol of Sp. gr.	A solution (saturated at 15°) in alcohol of Percent, by weight.	Contains percent of Zn O, SO_3 + 7 Aq.
1.000	0	54.5
0.986	10	51.1
0.972	20	39.0
0.939	40	3.48

(H. Schiff, *Ann. Ch. u. Pharm.*, 1861, **118**. 365.)

Sulphate of zinc may be completely precipitated from its aqueous solution by adding a suitable quantity of concentrated acetic acid. (Persoz, *Ann. Ch. et Phys.*, 1836, (2.) **63**. 444.) When a hot solution of sulphate of zinc is cooled out of contact with the air, or in a vessel loosely stopped with cotton-wool, a supersaturated solution may be obtained, from which a modification (β) of the 7-hydrated salt, more soluble than the ordinary modification (α), crystallizes out after a time, when the solution remains protected by the cotton, but if the supersaturated solution be exposed to the air, or be stirred with a body which has been exposed to the air, ordinary (α) sulphate of zinc crystallizes out at once. (Schrœder, *Ann. Ch. u. Pharm.*, 1859, **109**. 51.)

Very rapidly soluble in a saturated aqueous solution of sulphate of potash, a double salt separating meanwhile as a mealy powder. (Karsten, *Berlin Abhandl.*, 1840, p. 126.) Very rapidly and abundantly soluble in a saturated solution of sulphate of soda. The solution obtained remains clear for days, but on being evaporated deposits crystals of a double salt. If it be strongly heated and then quickly cooled it will deposit sulphate of zinc and sulphate of soda uncombined with each other. (Karsten, *loc. cit.*, p. 124.) Abundantly soluble in a saturated solution of sulphate of copper, at first to a clear solution, but as this becomes nearly saturated a double salt separates out. (Karsten, *loc. cit.*, p. 127.) Slowly soluble in a saturated solution of sulphate of magnesia, without causing any precipitation. Difficultly and slowly soluble in a saturated solution of chloride of ammonium, with separation of a double sulphate. (Karsten, *loc. cit.*, p. 128.) Soluble in considerable quantity in a saturated solution of chloride of sodium, without causing any precipitation at first, but as the solution approaches saturation sulphate of soda separates out. No double salt is formed unless the solution is slowly evaporated. (Karsten, *loc. cit.*, p. 128.) Crystallized sulphate of zinc is soluble in a saturated solution of nitrate of soda without causing any precipitation of the latter; after a while, however, a double sulphate separates out. (Karsten. *loc. cit.*, p. 116.) Soluble in a saturated solution of nitrate of potash with formation of a double sulphate, which immediately separates out. (Karsten, *loc. cit.*, p. 130.)

When one equivalent of ZnO, SO_3, in aqueous solution, is mixed with a solution of an equivalent of chloride of potassium (KCl), $\frac{84}{100}$ of it are decomposed to sulphate of potash, which may be precipitated by adding alcohol, while $\frac{16}{100}$ of it remain unchanged; when mixed with a solution of an equivalent of chloride of sodium ($NaCl$), $\frac{72}{100}$ of it are decomposed as before, while $\frac{48}{100}$ of it remain unchanged. (Malaguti, *Ann. Ch. et Phys.*, 1853, (3.) **37.** 203.)

II.) *bi.* $ZnO, 2SO_3 + 9Aq$ Difficultly soluble in cold, easily soluble in warm water. (v. Kobell.)

III.) *di.* $2ZnO, SO_3$ Soluble in water.

IV.) *tri.* $3ZnO, SO_3$ Insoluble in cold, and only very sparingly soluble in hot water. (Vogel [T.].)

V.) *tetra.* $4ZnO, SO_3 + 2Aq$ Insoluble in cold, scarcely at all soluble in boiling water; but soluble in a boiling aqueous solution of sulphate of zinc. (Kuehn.)

VI.) *hexa.* $6ZnO, SO_3 + 10Aq$ Insoluble in water. (Kane.)

VII.) *octo.* $8ZnO, SO_3 + 2Aq$ Insoluble in water. (Schindler.)

Sulphate of Zinc & Zincammonium.

I.) *basic.* Insoluble in water. (Schindler.)

$2ZnO, 2N\left\{\begin{matrix}H_3\\Zn\end{matrix}\right.O . SO_3 + 4Aq$

Sulphate of Zinc*bi*amin. $N_2\left\{H_6 . ZnO, SO_3 + Aq \;\&\; 2Aq \;\&\; 4Aq\right.$ Completely soluble in a small quantity of water.

Sulphate of Zincammonium. $N\left\{\begin{matrix}H_3\\Zn\end{matrix}\right. . O, SO_3 \;\& + Aq$ Decomposed by water. (Kane.)

Sulphate of Zirconia.

I.) *normal.* $Zr_2O_3, 3SO_3$ Slowly soluble in cold, rapidly soluble in boiling water. Sparingly soluble in alcohol. (Berzelius.) On boiling the aqueous solution it undergoes decomposition, oxide of zirconium being deposited. (H. Rose, *Pogg. Ann.*, **83.** 148.)

II.) *di.* $2Zr_2O_3, 3SO_3$ Soluble in a very small quantity of water; but a large quantity of water decomposes it to the tri salt, which separates out, and the normal salt, which remains in solution. (Berzelius.)

III.) Zr_2O_3, SO_3 Insoluble in water or alcohol. Soluble in chlorhydric acid. (Berzelius.)

SulphAuric Acid. *Vid. ter*Sulphide of Gold.

SulphAurate of Potassium. Known only in aqueous solution.

SulphAzoticChloride of Nitrogen. *Vid.* Chloride of Nitrogen with *bi*Sulphide of Nitrogen.

SulphAzoticChloride of Sulphur. *Vid.* Chloride of Sulphur with *ter*Sulphide of Nitrogen.

SulphAzotide of Benzene. *Vid.* Hydride of SulphAzoBenzoyl.

Sulphessal. *Vid.* Thionessal.

SulphEthamic Acid. $C_{16}H_{23}NS_4O_{16}$ Very easily soluble in water, and alcohol; but these solutions are decomposed by concentration.

SulphEthamate of Ammonia. $C_{16}H_{22}(NH_4)NS_4O_{16}$ Deliquesces in moist air. Easily soluble in water, and alcohol. Insoluble in ether. (Strecker.)

SulphEthamate of Baryta. Very soluble in water.

SulphEthamate of Lead. Very soluble in water, and spirit. Sparingly soluble in absolute alcohol.

***Bi*SulphEtholic Acid.** $C_4H_6S_4O_{12} = C_4H_4''O_2, 2HO, S_4O_8$ Very deliquescent. Easily soluble in water, and alcohol. (Buff.)

***Bi*SulphEtholate of Ammonia.** $C_4H_4(NH_4)_2S_4O_{12}$ Easily soluble in water. Scarcely at all soluble in alcohol. Insoluble in ether.

***Bi*SulphEtholate of Baryta.** $C_4H_4Ba_2S_4O_{12} + 2Aq$ Very soluble in boiling, less soluble in cold water. Almost insoluble in alcohol. Insoluble in concentrated, but soluble in dilute nitric acid. (Buff.)

***Bi*SulphEtholate of Lead.** Very soluble in water.

***Bi*SulphEtholate of Potassium.** $C_4H_4K_2S_4O_{12}$ Easily soluble in water, and spirit. (H. L. Buff, *Ann. Ch. u. Pharm.*, **100.** 233.)

***Bi*SulphEtholate of Silver.** (Buckton & Hofmann, *J. Ch. Soc.*, **9.** 252.)

SulphEtheric Acid. *Vid.* Isethionic Acid.

***Bi*SulphEthylic Acid.** *Vid.* EthylSulphurous Acid.

SulphEthylSulphuric Acid. *Vid.* EthylSulphurous Acid.

Sulphides. Among the metallic sulphides those only are soluble in water which correspond to the soluble oxides. (Persoz, *Chim. Moléc.*, p. 462.)

Sulphide of Acetyl. (*Sulphide of Othyl, or of Acetoxyl. Thiacetic Anhydride. Thiacetate of Othyl.*) $C_4H_3O_2S$, or $\left.\begin{matrix}C_4H_3O_2\\C_4H_3O_2\end{matrix}\right\}S_2$ Insoluble in water. Slowly decomposed when kept in contact with water. (Kekulè, *Ann. Ch. u. Pharm.*, **90.** 312.)

Sulphide of Allyl. (*Oil of Garlic.*) C_6H_5S, or $\left.\begin{matrix}C_6H_5\\C_6H_5\end{matrix}\right\}S_2$ Sparingly soluble in water. Easily soluble in alcohol, and ether. (Wertheim.)

Sulphide of Allyl & of Mercury. $\left.\begin{matrix}C_6H_5\\Hg\end{matrix}\right\}S_2$ Soluble in boiling, less soluble in cold alcohol. (Cahours & Hofmann.)

Sulphide of Allyl & of Palladium. $2C_6H_5S; 3PdS$ Insoluble in water, alcohol, or ether.

Sulphide of Allyl & of Platinum. $C_6H_5S; PtS_2$ Insoluble in water, alcohol, or ether. (Wertheim.)

Sulphide of Allyl & of Silver. $C_{12}H_{10}S_2; x\,AgS$

Sulphide of Aluminum. Al_2S_3 Decomposed by water. (Fremy, *Ann. Ch. et Phys.*, (3.) **38.** 323.) The compounds of sulphide of aluminum, with other sulphur metals, are all easily decomposed by water. (Berzelius, *Lehrb.*, **2.** 166.)

Sulphide of Ammonium.

I.) *mono.* (*Mono Hydro Sulphate of Ammonia.*) NH_4S Rapidly decomposes in the air. Soluble in water.

II.) *bi.* NH_4S_2 Known only in aqueous solution. (Berzelius.)

III.) *ter.* NH_4S_3 Soluble in a small quantity of water, but is decomposed by much water. (Berzelius.)

IV.) *quadri.* (*Hypohydro Sulphate of Ammonia.*) NH_4S_4 Easily soluble in water; the concentrated aqueous solution may be preserved for a long time, but when dilute the solution soon decomposes. Easily soluble in alcohol, but this solution soon decomposes. (Fritzsche.)

V.) *quinqui.* (*Hydro Sulphite of Ammonia.*) NH_4S_5 Decomposes in the air, especially if this be moist. Decomposed by water, with partial solution. Soluble in alcohol, with subsequent partial decomposition. (Fritzsche.)

VI.) *septi.* (*HypohydroSulphite of Ammonia.*) NH_4S_7 Much more permanent than No. 5. Insoluble in water, but is decomposed thereby, though much more slowly and difficultly than the quinqui sulphide. (Fritzsche.)

Sulphide of Ammonium & *biSulphide* of Vanadium. Soluble in water.

Sulphide of Ammonium & *terSulphide* of Vanadium.

Sulphide of Amyl. (*AmylSulphydric Ether.*) $C_{10}H_{11}S$, or $\left.\begin{matrix}C_{10}H_{11}\\C_{10}H_{11}\end{matrix}\right\}S_2$ Insoluble in water. Miscible in all proportions with alcohol, and ether. (Kolbe's *Lehrb.*, **1.** 319.)

*Bi*Sulphide of Amyl. $C_{10}H_{11}S_2$, or $\left.\begin{matrix}C_{10}H_{11}\\C_{10}H_{11}\end{matrix}\right\}S_4$ Insoluble, or very sparingly soluble, in water. Unacted upon either by hot or cold concentrated chlorhydric acid, or aqua-regia, or by cold sulphuric acid, but is partially decomposed when heated with the latter. Unacted upon by ammonia-water, and scarcely at all by a concentrated aqueous solution of caustic potash. (O. Henry, *Ann. Ch. et Phys.*, (3.) **25.** 247.)

Sulphide of Amyl & of Copper. Ppt.

Sulphide of Amyl & of Lead. Ppt.

Sulphide of Amyl & of Mercury (HgS). Insoluble in water. Unacted upon by boiling potash-lye. Sparingly soluble in boiling alcohol, and ether, and still less so in the cold. (Krutsch.) Insoluble in water or alcohol. Soluble in ether. (Balard.)

Sulphide of Amyl & of Silver. Insoluble in water, and in alcohol. Soluble in ether. (Balard.)

*Ter*Sulphide of Antimony. (*SulphAntimonious Acid*), *q. v.* SbS_3 Insoluble in water or dilute acids. Soluble, with decomposition, in concentrated acids. When boiled with water, or when left for a long time in contact with water and air, it suffers decomposition. Abundantly soluble, with combination, in a boiling solution of acid chlorhydrate of teroxide of antimony. (Liebig.) Soluble in a boiling aqueous solution of trisulphantimoniate of sodium ($3NaS, SbS_5 + 18 Aq$).

Soluble in an aqueous solution of sulphydrate of ethylamin. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **30.** 484.) Easily soluble in an aqueous solution of sulphide of ammonium.

Soluble in a boiling aqueous solution of sulphydrate of potassium, with evolution of sulphuretted hydrogen, but is redeposited in great part in combination with a small quantity of sulphide of potassium, as the solution cools. (Berzelius's *Lehrb.*, **2.** 299.) Very sparingly soluble in ammonia-water. (Garot.) Partially soluble in solutions of the carbonates of potash and soda. Soluble in solutions of the caustic alkalies, best when these are hot and concentrated, especially when it is moist, i. e. when recently precipitated and not yet dry.

When heated to about 250° in a closed tube, with a solution of bicarbonate of soda, it dissolves, and is subsequently deposited in crystals upon the sides of the tube. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 159.) Insoluble in sulphurous acid. (Berthier.) Insoluble in aqueous solutions of chloride of ammonium, or carbonate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Soluble, with decomposition, in boiling concentrated chlorhydric acid. Boiling concentrated sulphuric acid converts it into sulphate of antimony, and concentrated nitric acid oxidizes, but does not dissolve it.

*Quadri*Sulphide of Antimony. SbS_4 Insoluble in water. Slightly soluble in sulphuretted hydrogen-water. Soluble in ammonia-water. (Capitaine.) Soluble in boiling chlorhydric acid, with decomposition. (Berzelius.)

*Quinqui*Sulphide of Antimony. (*SulphAntimonic Acid.*) SbS_5 Insoluble in water. Slightly soluble in sulphuretted hydrogen-water. Soluble in 50 pts. of cold dilute ammonia-water. (Geiger.) Easily soluble in aqueous solutions of the alkaline sulphides, and of the caustic alkalies. Insoluble in cold, but soluble in boiling aqueous solutions of the alkaline carbonates. When boiled with liquids capable of dissolving sulphur, like alcohol, ether, bisulphide of carbon, or oil of turpentine, it is decomposed, a portion of its sulphur being dissolved. (Berzelius, *Lehrb.*, **2.** 307.) When heated in a closed tube to about 250°, with an aqueous solution of bicarbonate of soda, it is decomposed, crystals of SbS_3 being deposited, while sulphur separates. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 159.) Insoluble in acids which have no oxydizing action upon the antimony. Soluble, with decomposition, in hot strong chlorhydric acid. Insoluble in an aqueous solution of tersulphantimoniate of sodium ($3NaS, SbS_5 + 18 Aq$).

Sulphide of Arsen*tri*Ethyl. $As\left\{(C_4H_5)_3, S_2\right.$ Permanent. Readily soluble in warm water, and in alcohol (spirit). Almost insoluble in cold, but readily soluble in warm ether. (Landolt, *Ann. Ch. u. Pharm.*, **89.** 327.)

*Bi*Sulphide of Arsenic. (*HypoSulphArsenious Acid. Realgar.*) AsS_2 Insoluble in water. Soluble in aqueous solutions of the alkaline sulphides, and, with decomposition, of the caustic alkalies.

When heated to about 150° in a sealed tube, with an aqueous solution of bicarbonate of soda, it dissolves, and is subsequently deposited in crystals upon the walls of the tube. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 158.)

The compounds of bisulphide of arsenic, with lower metallic sulphides, are generally difficultly soluble in water. [*Vid.* HypoSulphArsenites.]

*Ter*SULPHIDE OF ARSENIC.
(*Orpiment. SulphArsenious Acid.*)
$a = As\,S_3$
When prepared in the dry way it is insoluble in water [P. & F.], but when prepared in the moist way, by the action of sulphuretted hydrogen upon an aqueous solution of arsenious acid, it is soluble to a certain extent in water, or, rather, transparent particles of the sulphide are suspended in the water; for on allowing the solution to stand the sulphide of arsenic gradually separates out. (Berzelius, *Lehrb.*, **2.** 269.) Sulphide of arsenic is decomposed to a certain extent, with evolution of sulphuretted hydrogen, when boiled with water. (Pfaff; Huenefeld, *Ann. der Pharm*, **20.** 224.) Precipitated from its aqueous solution on heating or freezing. (Boutigny; Pfaff.) Very sparingly soluble in warm water, from which it is precipitated by freezing or boiling, or by the addition of acids, in the following order: sulphuric (most readily), chlorhydric, nitric, oxalic, acetic, tartaric, or even carbonic; solutions of several salts produce the same effect: as, of chloride of ammonium, nitrate of potash, sulphate of soda, and sulphate of magnesia. Somewhat soluble in an aqueous solution of sulphuretted hydrogen. (Melsens, *Ann. Ch. et Phys.*, (3.) **33.** 175.) Insoluble in the acids generally. Insoluble in cold, and scarcely attacked by boiling chlorhydric acid. Easily soluble, with decomposition, in nitric acid and aqua-regia. Easily soluble, with decomposition, in aqueous solutions of the caustic and carbonated alkalies; also, with combination, in solutions of the alkaline sulphides.

When heated to about 150° with bicarbonate of soda in a sealed tube, it sometimes behaves like the bisulphide ($As\,S_2$), *q. v.*, but the reaction in the present case appears to occur only at a certain particular temperature, or to depend upon some special state of concentration of the alkaline solution. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 158.)

b = *hydrated.*
$As\,S_3, 3\,H\,O$
Slightly soluble in water. Insoluble in water containing sulphuretted hydrogen. (Berzelius.) Insoluble in water containing sulphuric, nitric, chlorhydric, oxalic, acetic, tartaric, or carbonic acids, or in solutions of chloride of ammonium, nitrate of potash, sulphate of soda, or sulphate of magnesia. (Boutigny, *J. Chim. Méd.*, **8.** 449.) The best means of separating it entirely from its solution is to keep the latter supersaturated with sulphuretted hydrogen, and warm.

Readily soluble in citric acid, and in solutions of the soluble citrates; consequently arsenious acid cannot be precipitated by means of sulphuretted hydrogen from solutions which contain citric acid. (Spiller.)

Insoluble in water, that is to say, 1 pt. of it requires about 1000000 pts. of water to dissolve it. (Fresenius, *Quant.*, p. 156.) Traces of it are dissolved by sulphuretted hydrogen-water. When boiled with water, or kept in contact with cold water during several days, a trace of it is decomposed and dissolved. (Fresenius, *Quant.*, p. 156.)

*Quinqui*SULPHIDE OF ARSENIC.
(*SulphArsenic Acid.*)
$As\,S_5$
Insoluble in boiling water. Easily soluble, with partial decomposition, in aqueous solutions of the caustic alkalies, and of their sulphides and carbonates. Easily soluble in strong ammonia-water, but dilute ammonia-water decomposes it, with separation of sulphur. Also soluble in solutions of the hydrates of the alkaline earths.

Readily soluble in citric acid, and in solutions of the soluble citrates. (Spiller.) Partially decomposed by alcohol. When the precipitated sulphide is boiled with alcohol, this dissolves out some sulphur. (Berzelius, *Lehrb.*, **2.** 270.)

*Hyper*SULPHIDE OF ARSENIC.
$As\,S_{18}$
Soluble in alcohol. (Berzelius.)

SULPHIDE OF ARSENMETHYL.
C_2H_3As'', S_2
Permanent. Insoluble in water. Moderately soluble in alcohol, either anhydrous or hydrated. Moderately soluble in ether. Very readily soluble in bisulphide of carbon. (Bæyer.)

SULPHIDE OF ARSEN*tri*METHYL.
$As\{(C_2H_3)_3, S_2$
Soluble in water, and alcohol. (Cahours.)

SULPHIDE OF ARSENMETHYLETHYLIUM.

SULPHIDE OF BARIUM.

I.) *mono.*
(*Sulphuret of Baryta.*)

$a = Ba\,S$
Soluble in cold, more readily in hot water, but is decomposed in either case to hydrate of baryta and sulphydrate of barium, &c. (H. Rose.) The compounds of sulphide of barium, with the higher metallic sulphides, are generally difficultly soluble in water. (Berzelius.)

b = *hydrated.*
$Ba\,S + 6\,Aq$
Decomposes in the air. When treated at once with a sufficient quantity of water it dissolves completely; but a smaller amount of water decomposes it; sulphydrate of barium entering into solution while baryta is left undissolved. (H. Rose.)

II.) *ter.*
$Ba\,S_3$

III.) *quinqui* (*hydrated*).
$Ba\,S_5 + x\,Aq$
Decomposed by the air. Easily soluble in water, and alcohol.

SULPHIDE OF BARIUM & OF IRON.

SULPHIDE OF BARIUM & OF LEAD. Decomposed by water. (Berthier.)

SULPHIDE OF BARIUM & OF POTASSIUM. Soluble in water, with evolution of heat. (Berthier.)

SULPHIDE OF BARIUM with SULPHOCYANIDE OF ALLYL.
$2\,Ba\,S; C_8H_5N\,S_2 + 2\,Aq \,\&\, 6\,Aq$
Soluble in water. Insoluble in alcohol. (Will.)

SULPHIDE OF BENZOL.
(*SulphoBenzol. Sulphide of Benzylene.*)
$C_{14}H_6'', S_2$
Insoluble in water. Tolerably readily soluble in boiling, sparingly soluble in cold alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **23.** 333.)

SULPHIDE OF BENZOYL.
$C_{14}H_5O_2S$, or $\left.\begin{matrix}C_{14}H_5O_2\\C_{14}H_5O_2\end{matrix}\right\}S_2$
Appears not to be decomposed by water, even when this is boiling. Is not decomposed by alcohol. Only slowly soluble, decomposed by a boiling aqueous solution of caustic potash. (Wœhler & Liebig, *Ann. der Pharm.*, 1832, **3.** 267.)

SULPHIDE OF BISETHYL.
SULPHIDE OF BISMETHYL.
Vid. Sulphide of Bismuth-Ethyl.

Sulphide of Bismuth.

I.) Insoluble in water. Decomposed by acids.
$Bi\,S_2 + 2\,Aq$ (Schneider.)

II. Permanent. Insoluble in water, dilute
$Bi\,S_3$ acids, solutions of alkalies, alkaline sulphides, or cyanide of potassium. Soluble, with decomposition, in warm tolerably concentrated nitric acid. (Fresenius, *Quant.*, p. 150.) Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.)

Sulphide of bismuth obtained in the wet way does not dissolve sensibly when heated to about 200° in a sealed tube with an aqueous solution of bicarbonate of soda. It dissolves, however, if an alkaline sulphide be substituted for the $Na\,O\,2\,C\,O_2$, and subsequently crystallizes on the walls of the tube. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 161.)

Sulphide of Bismuth & of Copper. Soluble, with decomposition, in nitric acid.

Sulphide of Bismuth, of Copper, & of Lead. Soluble, with decomposition, in nitric acid.
$(Bi\,Cu, Pb_2)_2\,S_6$

Sulphide of Bismuth & of Lead.
(*SulphoBismuthate of Lead.*)
$Bi\,S_3 ; 3\,Pb\,S$

Sulphide of Bismuth & of Nickel. Readily soluble, with decomposition, in strong nitric acid. Decomposed by hot chlorhydric acid. Not decomposed by an aqueous solution of caustic potash.
(*Bismuth Glance.*)
$(Bi\,Ni)\,S$

Sulphide of Bismuth & of Tellurium. Ppt.

Sulphide of Bismuth with Telluride of Bismuth. Readily soluble, with decomposition, in nitric acid.
$Bi\,S_3, 2\,Bi\,Te_3$

Sulphide of BismuthEthyl. Soluble in alcohol.
$Bi\,\}\,(C_4\,H_5)_3, S_2 ; 2\,Bi\,S_3$

Sulphide of Boron. Decomposed with violence by water. (Berzelius.) It combines with alcohol, and ether. (Fremy.)
$B\,S_3$

Sulphide of BromoSalicene. Soluble in alcohol, from which solution it is precipitated on the addition of water. Soluble in an aqueous solution of caustic potash.
(*Hydride of BromoSulphoSalicyl. SulphoBromoSalicylous Acid.*)
$C_{14}\,H_5\,Br\,O_2\,S_2$

Sulphide of Butyl & of Lead. Ppt.
(*ButylSulphide of Lead.*)
$C_8\,H_9\,S ; Pb\,S$

Sulphide of Butyl & of Mercury. Soluble in hot, somewhat less soluble in cold alcohol. (Humann, *Ann. Ch. et Phys.*, (3.) **44.** 339.)
$C_8\,H_9\,S ; Hg\,S$

Sulphide of Butyl & of Potassium. Soluble in alcohol.
$C_8\,H_9\,S ; K\,S$

Sulphide of Butyryl & of Lead. Sparingly soluble in hot water, or alcohol, crystallizing out on cooling.
$C_8\,H_7\,O_2\,S ; Pb\,S$

Sulphide of Cacodyl. Almost insoluble in water. Miscible in all proportions with alcohol and ether. Water precipitates it from the alcoholic solution.
$\left.\begin{matrix}(C_2\,H_3)\,As\\(C_2\,H_3)\,As\end{matrix}\right\}S_2$

***Bi*Sulphide of Cacodyl.** Permanent. Insoluble in water. Readily soluble in absolute alcohol, and in spirit, from which it is partially precipitated on the addition of water. Sparingly soluble in ether. Soluble in chlorhydric acid, without apparent decomposition. (Bunsen.)
$\left.\begin{matrix}(C_2\,H_3)\,As\\(C_2\,H_3)\,As\end{matrix}\right\}S_4$

Sulphide of Cacodyl & of Copper. Permanent. Soluble in alcohol.
$\left.\begin{matrix}(C_2\,H_3)\,As\\(C_2\,H_3)\,As\end{matrix}\right\}S_2 ; 6\,Cu\,S$

Sulphide of Cadmium. Insoluble in water,
$Cd\,S$ dilute acids, solutions of the alkalies, alkaline sulphides, or of cyanide of potassium. Soluble, with decomposition, in concentrated chlorhydric acid, also in tolerably concentrated nitric acid. (Fresenius, *Quant.*, p. 151.) Difficultly soluble in dilute chlorhydric acid, even when this is warm, but easily soluble, even in cold concentrated chlorhydric acid, also in nitric acid, with decomposition in both instances. Very slightly soluble in ammonia. (Wackenroder.) Very readily soluble in dilute sulphuric acid. (Hofmann.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.)

Sulphide of Calcium.

I.) *mono.* Soluble in 500 pts. of water; but
$Ca\,S$ when treated with less water it is decomposed to $Ca\,S, H\,S$ (soluble), and sparingly soluble $Ca\,O, H\,O$. It is also decomposed by boiling water.

1 pt. of *calcaria sulphurata* is soluble in 480 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 210, in *Canstatt's Jahresbericht für* 1854, p. 75.) Freely soluble in glycerin. (Parrish's *Pharm.*, p. 236.) Soluble in acids.

II.) *bi.* Permanent. Soluble in 400 pts. of
$Ca\,S_2 + 3\,Aq$ water at 16°; more soluble in boiling water.

III.) *quinqui.*

$a = Ca\,S_5$ Soluble in water, and alcohol.

IV.) *basic.* *Vid.* OxySulphide of Calcium.

Sulphide of Calcium & of Iron.

Sulphide of Calcium & of Sodium.

Sulphide of Capryl. *Vid.* Sulphide of Octyl.

***Bi*Sulphide of Carbon.** *Vid.* SulphoCarbonic Acid.

Sulphide of Cerium. Insoluble in water.
$Ce\,S$ Soluble, with decomposition, even in the weakest acids.

Sulphide of Cetyl. Scarcely at all soluble in cold water. Easily soluble in ether; somewhat less soluble in boiling, and scarcely at all soluble in cold alcohol.
(*CetylSulphydric Ether.*)
$C_{32}\,H_{33}\,S$, or $\left.\begin{matrix}C_{32}\,H_{33}\\C_{32}\,H_{33}\end{matrix}\right\}S_2$

Sulphide of Cetyl & of Lead. Insoluble in water, alcohol, or ether.

Sulphide of *bi*ChlorEthyl. Insoluble in water.
$\left.\begin{matrix}C_4\,H_3\,Cl_2\\C_4\,H_3\,Cl_2\end{matrix}\right\}S_2$

Sulphide of *ter*ChlorEthyl.
$\left.\begin{matrix}C_4\,H_2\,Cl_3\\C_4\,H_2\,Cl_3\end{matrix}\right\}S_2$

Sulphide of *quadri*ChlorEthyl.
(*QuadriChlorinated Hydrosulphuric Ether. Sulfide d'Ethyle quadriChloré.*)
$\left.\begin{matrix}C_4\,H\,Cl_4\\C_4\,H\,Cl_4\end{matrix}\right\}S_2$

Sulphide of *mono*ChlorMethyl.
(*Sulphide of Methylmonochloré. TerChlorinated Methylic Sulphide.*)
$\left.\begin{matrix}C_2\,H_2\,Cl\\C_2\,H_2\,Cl\end{matrix}\right\}S_2$

Sulphide of *bi*ChlorMethyl.
$\left.\begin{matrix}C_2\,H\,Cl_2\\C_2\,H\,Cl_2\end{matrix}\right\}S_2$

Sulphide of *ter*ChlorMethyl. $\left.\begin{matrix}C_2Cl_3\\C_2Cl_3\end{matrix}\right\}S_2$ Entirely insoluble in water. Easily soluble in alcohol, and ether. (Riche, *Ann. Ch. et Phys.*, (3.) **43.** 288.)

Sulphide of *bi*ChlorMethylene? C_2Cl_2'', S_2 Unacted upon by water or acids, even fuming nitric acid. Slowly decomposed by potash-lye. (Kolbe.)

***Proto*Sulphide of Chromium.**

***Sesqui*Sulphide of Chromium.** Cr_2S_3 Insoluble in water. Soluble in nitric acid, and more easily in aqua-regia. Insoluble in aqueous solutions of caustic potash, or of sulphide of potassium. (Berzelius's *Lehrb.*, **2.** 328.)

***Proto*Sulphide of Cobalt.**

a = *anhydrous.* $Co\,S$ When prepared in the dry way, it is not at all attacked by cold dilute chlorhydric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **25.** 94.)

b = *hydrated.* $Co\,S, H\,O$ Insoluble in water, or in solutions of the caustic or carbonated alkalies, or of the alkaline sulphides. [Though on adding a solution of persulphide of potassium ($K\,S_5$) to the solution of a neutral cobalt salt no precipitate, but a chocolate-colored solution is obtained. (H. Rose, *Tr.*).] Sparingly soluble in cold dilute mineral acids, more readily soluble, with decomposition, in more concentrated acids; most readily soluble in warm aqua-regia. Scarcely at all soluble in acetic acid. (Wackenroder.) It is not precipitated when sulphydric acid is passed through an acid solution of acetate of cobalt, but this gas precipitates it from a mixture of sulphate of cobalt and acetate of potash or soda [i. e. from a less strongly acidified solution]. (Persoz, *Chim. Moléc.*, p. 387.) Tolerably easily soluble in nitric acid, but is very difficultly decomposed by chlorhydric acid. While still moist it dissolves in an aqueous solution of sulphurous acid.

Insoluble in aqueous solutions of chloride of ammonium and nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) It is not immediately precipitated by sulphuretted hydrogen from neutral solutions of cobalt salts, unless the acids contained in these are very feeble, like acetic acid, and even this hinders the precipitation in a measure, but after some time a minute trace of the sulphide may separate out. If the solution be acidulated, even with acetic acid, no precipitate whatever will occur on passing sulphuretted hydrogen, though, when once precipitated, sulphide of cobalt is insoluble, or rather is scarcely at all soluble in dilute chlorhydric acid. Sulphide of ammonium produces a brown coloration in solutions of cobalt salts, even in presence of 200000 pts. of water. (Pfaff.) Its precipitation by sulphide of ammonium is not hindered by the presence of non-volatile organic substances, like tartaric acid. (H. Rose, *Tr.*)

***Sesqui*Sulphide of Cobalt.** Co_2S_3 Partially decomposed by chlorhydric acid. Soluble, with decomposition, in nitric acid.

***Bi*Sulphide of Cobalt.** $Co\,S_2$ Unacted upon by acids or alkalies, excepting nitric acid and aqua-regia.

***Di*Sulphide of Copper.** $Cu_2\,S$ Insoluble in an aqueous solution of sulphide of ammonium. Difficultly soluble, with decomposition, in strong boiling chlorhydric and nitric acids. Cold nitric acid removes one equivalent of copper, leaving Cu S.

***Proto*Sulphide of Copper.** $Cu\,S$ As good as insoluble in water, since 950000 pts. of water are required to dissolve 1 pt. of it. (Fresenius, *Quant.*, p. 148.) Easily soluble, with decomposition, in hot nitric acid. Slowly soluble, with decomposition, in hot chlorhydric acid. Insoluble in sulphurous acid. Insoluble in potash-lye, in solution of alkaline sulphides, or in very dilute acids.

Perceptibly soluble in sulphide of ammonium. (Fresenius, *loc. cit.*) Insoluble, or only exceedingly sparingly soluble, in sulphide of ammonium. (H. Rose, *Tr.*) Soluble in noticeable quantity in aqueous solutions of the alkaline sulpharseniates, sulphantimoniates, and sulphostannates. For example, if a dilute solution of a copper salt be dropped into a solution of sulphide of arsenic in sulphide of ammonium, the brown precipitate, which is formed at first, dissolves on agitation, and the liquor becomes clear. Particularly large quantities are dissolved by sulphantimoniate of sodium. This solvent action appears to be less marked when the solutions are warm, and even at the ordinary temperature the sulphide of copper separates out again partially when the solution is allowed to stand. It is probable that many other basic sulphides behave with these solvents similarly to sulphide of copper. (Wœhler, *Ann. Ch. u. Pharm.*, 1840, **34.** 236.) When a mixed precipitate of sulphide of copper and tersulphide of arsenic is treated, while still moist, with an aqueous solution of sulphide of potassium, a portion of the sulphide of copper dissolves as well as the sulphide of arsenic. (W. H. Chandler, Private communication, 1863.)

Easily soluble, with decomposition, in an aqueous solution of cyanide of potassium. (Haidlen & Fresenius.) Soluble in a solution of bicarbonate of potash. (Berzelius.) Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Precipitated, by sulphuretted hydrogen or sulphide of ammonium, as a brown coloration, in presence of 100000 pts. of water (Pfaff); 200000 pts. of water (Lassaigne); in presence of 15000 pts. of water, + 7500 pts. of chlorhydric acid, a slight color is produced, but with 40000 pts. of water, + 20000 pts. of chlorhydric acid, this is no longer visible. (Reinsch.)

***Quinqui*Sulphide of Copper.** $Cu\,S_5$ Insoluble in water. When recently precipitated, it is soluble in an aqueous solution of carbonate of potash.

Sulphide of Copper & of Ethyl. $C_4H_5S, Cu\,S$ Insoluble in water. Sparingly soluble in alcohol. Soluble in moderately strong chlorhydric acid.

Sulphide of Copper & of Iron. (*Copper Pyrites.*) Cu_2S, Fe_2S_3 Permanent. Insoluble in chlorhydric acid. When heated in a sealed tube, with a solution of sulphuretted hydrogen, a portion of it dissolves, though with difficulty, and is subsequently deposited. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 168.)

***Proto*Sulphide of Copper & of Phosphorus.**

I.) $2\,Cu\,S; P\,S_5$
II.) $8\,Cu\,S; P\,S_5$

***Di*Sulphide of Copper & of Silver.** $Cu_2\,S; Ag\,S$ Soluble, with decomposition, in nitric acid.

***Di*Sulphide of Copper & of Phosphorus.** $2\,Cu_2\,S; P\,S_5$

Sulphide of Didymium. Insoluble in water. DiS Soluble, with decomposition, in acids, even when these are very dilute. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 159.)

Sulphide of Ethyl. Insoluble, or very (*SulphEthyl.*) C_4H_5S or $\left.\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\right\}S_2$ sparingly soluble, in water. Easily soluble in alcohol, and ether.

*Bi***Sulphide of Ethyl.** Very sparingly soluble in water. (*Thialöl* (of Zeise).) $C_4H_5S_2$ or $\left.\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\right\}S_4$ Very soluble in alcohol, and ether. Ether removes it completely from the aqueous solution. Very sparingly soluble in an aqueous solution of sulphuric acid, and not at all soluble in cold concentrated sulphuric acid. (Morin.)

*Quinqui***Sulphide of Ethyl.** Very soluble in $C_4H_5S_5$ alcohol. (Lœwig.)

*Ter***Sulphide of Ethyl.** Insoluble in water. $C_4H_5S_3$

Sulphide of Ethyl & of Gold. Insoluble $\left.\begin{matrix}C_4H_5\\Au\end{matrix}\right\}S_2$ in water or in cold alcohol. Not decomposed by chlorhydric or concentrated sulphuric acids at the ordinary temperature, nor by boiling potash-lye. (Zeise.)

Sulphide of Ethyl & of Lead. Soluble $\left.\begin{matrix}C_4H_5\\Pb\end{matrix}\right\}S_2$ in an alcoholic solution of acetate of lead. (Zeise.)

Sulphide of Ethyl & of Mercury. Permanent. (*Mercaptid.*) $\left.\begin{matrix}C_4H_5\\Hg\end{matrix}\right\}S_2$ Insoluble in water. Soluble in 12 @ 15 pts. of boiling alcohol of 80%, separating out again for the most part as the solution cools. (Liebig.) Water precipitates it from the alcoholic solution. (Zeise.) Soluble in boiling ether. More readily soluble in alcohol, which contains bisulphide of ethyl, or in sulphydrate of ethyl, than in ordinary alcohol. (Zeise.) Unacted upon by a boiling aqueous solution of caustic potash. Slowly soluble in warm dilute chlorhydric acid.

Sulphide of Ethyl & of Platinum. In- $\left.\begin{matrix}C_4H_5\\Pt\end{matrix}\right\}S_2$ soluble in alcohol.

Sulphide of Ethyl & of Potassium. C_4H_5S, KS Quickly and abundantly soluble in water; the solution undergoing decomposition when exposed to the air; less soluble in alcohol than in water. Decomposed by weak chlorhydric or sulphuric acids.

Sulphide of Ethyl & of Silver. Insol- C_4H_5S, AgS uble in water or alcohol. (Zeise.)

Sulphide of Ethyl & of Sodium. Readily C_4H_5S, NaS soluble in water. (Zeise.)

Sulphide of Ethyl & of Zinc. Ppt. C_4H_5S, ZnS

*Proto***Sulphide of Ethylene.** Insoluble in C_4H_4'', S_2 water. Very sparingly soluble in alcohol. Soluble in ether.

*Quadri***Sulphide of Ethylene.** Insoluble C_4H_4'', S_4 in water or alcohol. Very sparingly soluble in strong boiling caustic lye, from which it is deposited on cooling. (Lœwig & Weidmann.)

*Quinqui***Sulphide of Ethylene.** Unacted upon by potash-lye. (Lœwig & Weidmann.)

Sulphide of *tri*EthylPhosphin. Very $P\left\{(C_4H_5)_3, S_2\right.$ sparingly soluble in cold, much more soluble in hot water. More soluble in alcohol, and ether, than in water; and soluble to almost any extent in bisulphide of carbon. Less soluble in alkaline liquids than in water. More soluble in chlorhydric acid, especially if it is concentrated, than in water. Also soluble in dilute sulphuric and nitric acids, but is decomposed by concentrated nitric acid. (Hofmann & Cahours.)

Sulphide of Formyl. *Vid.* ThioFormic Acid.

Sulphide of Glucinum. Slowly soluble, without decomposition, in water. (Wœhler.) Easily decomposed by acids. With the higher sulphides it forms salts easily soluble in water. (Berzelius.)

*Proto***Sulphide of Gold.**
AuS

"*Bi, or black,* **Sulphide of Gold.**" Levol "AuS_2" (*Ann. Ch. et Phys.*, 1850, (3.) 359) doubts the existence of either Au S or Au S_3.

*Ter***Sulphide of Gold.** Insoluble in water, AuS_3 or in chlorhydric, or nitric acid. Soluble in nitromuriatic acid. Insoluble in colorless, but almost completely soluble in yellow sulphide of ammonium. Soluble in caustic potash, with decomposition. Completely soluble in yellow sulphide of potassium, or in yellow sulphide of ammonium to which potash has been added. (Fresenius, *Quant.*, p. 152.) When in the nascent state it is soluble in aqueous solutions of the alkaline sulphides. (Dumas, *Tr.*) Soluble in aqueous solutions of the alkaline sulphides, also in a boiling solution of caustic potash, with separation of a certain quantity of metallic gold. (Berzelius, *Lehrb.*) Sparingly soluble in a cold aqueous solution of sulphide of sodium, but the solution is decomposed when boiled, with separation of tersulphide of gold. (Yorke.) It is precipitated even in presence of 2000 pts. of water (Pfaff); a brown color is still evident in presence of 10000 pts. of water, this is fainter with 20000 to 40000, and scarcely perceptible when 80000 pts. of water are used. (Lassaigne.)

Sulphide of Gold & of *X*. *Vid.* SulphAurate of *X*.

Sulphide of Hydrogen. *Vid.* Sulphydric Acid.

*Per***Sulphide of Hydrogen.** Decomposed (*Hydrosulphurous Acid.*) HS_5 by water, alcohol, and ether. Ether dissolves it at first, but sulphur soon separates from this solution. Insoluble in dilute chlorhydric acid. Instantly decomposed by alkaline solutions.

Sulphide of Hydrogen & of *X*. *Vid.* Sulphydrate of *X*.

*Proto***Sulphide of Iridium.** When prepared IrS in the moist way, by precipitating a solution of an iridium salt with sulphuretted hydrogen, it is slightly soluble in water. Insoluble in an aqueous solution of chloride of ammonium, or in acidulated water. More readily soluble in an aqueous solution of sulphide of potassium than bisulphide of platinum. Soluble in cold nitric acid. (Berzelius.) When prepared by igniting a higher sulphide it is insoluble in nitric acid, and but sparingly soluble in aqua-regia. (Berzelius.) Not at all soluble in aqua-regia. (Bœttger.)

*Sesqui***Sulphide of Iridium.** When pre- Ir_2S_3 pared in the dry way, it is scarcely attacked by aqua-regia. When prepared in the moist way, it is sparingly soluble in water, and soluble in an aqueous solution of sulphide of potassium, and in nitric acid. Readily soluble in sulphide of ammonium.

***Bi*Sulphide of Iridium.** $Ir\,S_2$ When obtained in the moist way, by precipitation, it is sparingly soluble in water, but is insoluble in an aqueous solution of chloride of ammonium, or in acidulated water. Soluble in an aqueous solution of sulphide of potassium, and in nitric acid. When prepared by digesting an iridium salt with bisulphide of carbon, it is soluble in aqua-regia, but is not decomposed by boiling aqueous solutions of caustic ammonia, or potash, or of carbonate of soda. (Bœttger.)

***Ter*Sulphide of Iridium.** $Ir\,S_3$ Sparingly soluble in water. Insoluble in an aqueous solution of chloride of ammonium, or in acidulated water. Soluble in a solution of sulphide of potassium, and in nitric acid. (Berzelius.)

***Proto*Sulphide of Iridium & of Potash.** Partially soluble in water. (Berzelius.)

***Sub*Sulphide of Iron.** $Fe_8\,S$ Easily soluble in acids. (Arfvedson.)

***Di*Sulphide of Iron.** $Fe_2\,S$ Soluble, with decomposition, in acids. (Arfvedson.)

***Proto*Sulphide of Iron.**

a = $Fe\,S$ When prepared in the dry way (from $Fe_2\,O_3$ & $H\,S$) it is not soluble in cold dilute chlorhydric acid, and if protosulphide of cobalt is present, it is scarcely soluble in concentrated chlorhydric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **25.** 97.)

b = *hydrated.* $Fe\,S, H\,O$ Slightly soluble in water, especially when this is hot, with decomposition. (Berzelius; Vauquelin.) When precipitated from very dilute solutions it remains in suspension for a long while, and appears as if it were a dark-green solution. (Fresenius, *Quant.*, p. 140; H. Rose, *Tr.*) The presence of sulphuretted hydrogen, of sulphide of ammonium, especially when yellow, or of the alkaline sulphides, prevents this solution. (Berzelius; Fresenius, *Quant.*, p. 140.) A very dilute solution of sulphide of ammonium dissolves a trace of it, but deposits it on exposure to the air, or on addition of hydrosulphite of ammonia. (Wackenroder.) Insoluble in a solution of sulphide of ammonium. (H. Rose, *Tr.*) Soluble in acids, even very dilute, excepting carbonic, oxalic, tartaric, and acetic acids, and is somewhat soluble in these. (H. Rose.) Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Protosulphide of iron cannot be completely precipitated from solutions which contain citrate of soda. (Spiller.) Contrary to the assertion of Persoz, it is almost completely precipitated from solutions containing pyrophosphate of soda when these are treated with sulphide of ammonium. (H. Rose, *Pogg. Ann.*, 1849, **76.** 18.)

***Sesqui*Sulphide of Iron.** $Fe_2\,S_3$ Soluble in dilute sulphuric and chlorhydric acids. (Berzelius, *Lehrb.*, **2.** 723.)

***Bi*Sulphide of Iron.** (*Iron Pyrites.*) $Fe\,S_2$ Unacted upon by dilute chlorhydric or sulphuric acids. It is not attacked by acids, excepting nitric acid, aqua-regia, and boiling concentrated sulphuric acid. (Berzelius, *Lehrb*, **2.** 725.) When heated with a solution of sulphuretted hydrogen in a closed tube, it is partially dissolved, though this is accomplished with difficulty, and is subsequently again deposited. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 168.)

Sulphide of Iron & of Nickel. $2\,Fe\,S, Ni\,S$

Sulphide of Iron & of Phosphorus. $2\,Fe\,S, P\,S_3$ Insoluble in boiling chlorhydric acid. (Berzelius.)

Sulphide of Iron & of Potassium. Soluble in water. When concentrated, the aqueous solution is decomposed by boiling, but this does not occur when it is dilute. (H. Rose.)

Sulphide of Iron & of Silver. $2\,Fe_2\,S_3;\ Ag\,S$

Sulphide of Iron & of Sodium.

Sulphide of Lanthanum.

***Di*Sulphide of Lead.**

***Proto*Sulphide of Lead.** $Pb\,S$ Permanent. When prepared by precipitation it is insoluble in water, dilute acids, solutions of alkalies, or of alkaline sulphides. Soluble, with decomposition, in hot concentrated chlorhydric acid, and in warm tolerably concentrated nitric acid. (Fresenius, *Quant.*, p. 145.) Sulphuretted hydrogen does not precipitate lead from solutions which are strongly acid with nitric, chlorhydric, or sulphuric acid; and sulphite of lead which has been precipitated from dilute solutions, with sulphide of ammonium, is completely and not very difficultly redissolved by tolerably concentrated chlorhydric and nitric acids. Sulphuretted hydrogen-gas may be passed through these solutions, particularly through that in chlorhydric acid, without producing any precipitate, but on diluting the liquid with water sulphide of lead will separate out. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 321.) Insoluble in aqueous solutions of chloride of ammonium or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Soluble, with decomposition, in nitromuriatic acid.

Tolerably soluble in a solution of sulphuretted hydrogen, when heated therewith in a sealed tube. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 168.) When equal pts. of sulphide of lead, in fine powder, and of sulphate of copper are mixed in presence of 4 or 5 pts. of water they are slowly decomposed, sulphate of lead and sulphide of copper being formed; this decomposition is more rapid when the mixture is heated, or when chloride of sodium has been added to the latter, which occasions the formation of chloride of copper, which in its turn acts upon the sulphide of lead. (Becquerel, *C. R.*, 1845, **20.** pp. 1525-1529.)

Sulphide of Lead & of Methyl. $\left.\begin{matrix}Pb\\C_2\,H_3\end{matrix}\right\}S_2$ Ppt. (Gregory.)

Sulphide of Lead & of Silver.

Sulphide of Lead & of Sodium. Decomposed by water. (Berthier.)

Sulphide of Lithium. $Li\,S$ Considerably more soluble than hydrate of lithia in water, and in alcohol. (Berzelius, *Lehrb.*, **2.** 96.) Very soluble in water. (Troost, *loc. cit.*)

***Bi*Sulphide of Lithium.** $Li\,S_2$ Soluble in water. (Vauquelin.)

Sulphide of Magnesium. $Mg\,S$ Very sparingly soluble in cold water. This solution decomposes after a time, when left to itself, or immediately on heating. (Fremy, *Ann. Ch. et Phys.*, (3.) **38.** 324.) Soluble in acids, with decomposition.

Sulphide of Manganese.

a = *anhydrous.* Insoluble in water. Soluble MnS to a notable extent in water saturated with sulphuretted hydrogen. (Gorgeu, *Ann. Ch. et Phys.*, (3.) **42.** 73.) Decomposed by dilute acids, even by acetic acid.

When prepared in the dry way, it is soluble in cold dilute chlorhydric acid and in warm acetic acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **25.** pp. 94, 97.)

b = *hydrated.* Insoluble in water. Slightly MnS, HO soluble in solutions of sulphide of ammonium, which do not contain an excess of sulphur. Insoluble in yellow solutions of sulphide of ammonium (containing an excess of sulphur). (Wackenroder.) Insoluble in a solution of sulphide of ammonium, but not completely insoluble in solutions of ammoniacal salts; at all events, when in presence of the latter it is deposited very slowly. Nor is it completely insoluble in a very large proportion of water, even when this contains some sulphide of ammonium; hence it sometimes happens that one cannot precipitate it, by means of this reagent, from solutions which contain traces of protoxide of manganese, especially if the sulphide has been recently prepared and is colorless. Very easily soluble in chlorhydric acid, and in dilute acids generally. (H. Rose, *Tr.*) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Soluble in sulphuric, chlorhydric, nitric, sulphurous, and acetic acids, with decomposition. Not precipitated from solutions containing citrate of soda (it is even readily soluble in the alkaline citrates), or any of the normal tartrates, or grape-sugar, in the cold. Neither cane nor milk-sugar prevent its precipitation, however. (Spiller.) As a general rule, non-volatile organic substances do not prevent its precipitation by sulphide of ammonium. (H. Rose, *Tr.*) Not precipitated by sulphide of ammonium from the solution of a manganese salt in an excess of pyrophosphate of soda. (H. Rose, *Tr.*) With sulphur acids it forms salts, which are generally sparingly soluble in water. (Berzelius, *Lehrb.*)

SULPHIDE OF MANGANESE & OF PHOSPHORUS. MnS, PS Soluble, with decomposition, in chlorhydric acid. (Berzelius.)

SULPHIDE OF MANGANESE & OF POTASSIUM. $3MnS; KS$ Decomposed by acids, and by water containing air. Insoluble in water, alcohol, or ether.

SULPHIDE OF MANGANESE & OF SODIUM. $3MnS; NaS$ Decomposed by water containing air.

SULPHIDE OF MERCURETHYL. $\left.\begin{matrix}C_4H_5Hg_2\\C_4H_5Hg_2\end{matrix}\right\}S_2$ Soluble in cold alcohol, and ether. Easily soluble in an aqueous solution of sulphide of ammonium. (Duenhaupt.)

***Di*SULPHIDE OF MERCURY.** Hg_2S Insoluble in cold water, or dilute nitric acid, or in hot aqueous solutions of caustic ammonia, or sulphide of ammonium. Soluble, with separation of metallic mercury, in a solution of caustic potash. (H. Rose.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.)

***Proto*SULPHIDE OF MERCURY.** HgS There are two allotropic modifications: —

Modif. I.) (*Cinnabar. Red Sulphide.*) Insoluble in water, alcohol, dilute acid, or alkaline solutions. Decomposed by hot dilute nitric acid. Unacted upon by boiling water, alkaline solutions, or chlorhydric acid. Nitric acid acts upon it but feebly, but aqua-regia decomposes it at once. It is also decomposed by boiling sulphuric acid.

Readily soluble in a boiling concentrated solution of protochloride of copper ($Cu\,Cl$), no dichloride of copper or combination of sulphur, with hydrogen or oxygen, being formed. (Karsten, *Berlin Abhandl.*, 1828, p. 23.)

Modif. II.) (*Black Sulphide.*) Permanent. When prepared in the moist way, it is insoluble in water, and in dilute chlorhydric or nitric acid. Scarcely at all acted upon by hot concentrated nitric acid, and not at all by boiling chlorhydric. Easily soluble, with decomposition, in nitromuriatic acid. Absolutely insoluble in caustic potash-lye, even boiling, or in cyanide of potassium, or sulphide of ammonium. Easily soluble in a solution of sulphide of potassium which contains free alkali. (Fresenius, *Quant.*, pp. 146, 763.) Decomposed, with partial solution, by hot nitric acid. (Berzelius, *Lehrb.*, **2.** 535.) Slightly soluble in a solution of sulphide of barium. (Rammelsberg.) Insoluble in a solution of cyanide of potassium. (Haidlen & Fresenius.) Soluble in a potash solution containing sulphide of ammonium. (H. Rose.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Precipitated as a brown coloration in presence of 20000 pts. of water; as a slight green coloration in presence of 40000 pts. of water. (Lassaigne.)

SULPHIDE OF MERCURY & OF METHYL. $\left.\begin{matrix}C_2H_3\\Hg\end{matrix}\right\}S_2$ Soluble in hot, less soluble in cold alcohol.

SULPHIDE OF MERCURY & OF PHOSPHORUS.

I.) $2HgS; PS_3$

II.) $2HgS; PS_5$

SULPHIDE OF MERCURY & OF POTASSIUM. $HgS; KS + 5Aq$ Soluble in alkaline solutions. Decomposed by pure water.

SULPHIDE OF MERCURY & OF SODIUM. $HgS; NaS$ Soluble in alkaline solutions. Decomposed by pure water.

***Proto*SULPHIDE OF METHYL.** (*HydroSulphuric MethylEther. HydroSulphate of Methylene.*) C_2H_3S, or $\left.\begin{matrix}C_2H_3\\C_2H_3\end{matrix}\right\}S_2$ Insoluble in water. Easily soluble in alcohol. (Kolbe's *Lehrb.*, **1.** 268.)

***Bi*SULPHIDE OF METHYL.** $C_2H_3S_2$, or $\left.\begin{matrix}C_2H_3\\C_2H_3\end{matrix}\right\}S_4$ Scarcely at all soluble in water. Soluble in all proportions in alcohol, and ether. Soluble, without decomposition, in cold concentrated sulphuric acid, but is decomposed when heated therewith. (Cahours, *Ann. Ch. et Phys.*, (3.) **18.** 258.)

***Ter*SULPHIDE OF METHYL.** $C_2H_3S_3$, or $\left.\begin{matrix}C_2H_3\\C_2H_3\end{matrix}\right\}S_6$ Resembles the bisulphide.

SULPHIDE OF *tri*METHYLPHOSPHIN. $P\left\{(C_2H_3)_3S_2\right.$ Soluble in water.

***Bi*SULPHIDE OF MOLYBDENUM.** MbS_2 Soluble, with decomposition, in boiling concentrated sulphuric acid. Also soluble in aqua-regia. Nitric acid oxidizes, but does not dissolve it. Difficultly attacked by acids generally. Only slightly acted upon by potash-lye.

***Ter*SULPHIDE OF MOLYBDENUM.** MbS_3 Somewhat soluble in water, especially in hot water, but is precipitated therefrom on the addition of an acid, even sulphuretted hydrogen. (Berzelius.) Difficultly soluble in aqueous solutions of the caustic alkalies; more readily soluble in solutions of sulphide of potassium and the other alkaline sulphides, but still only slowly unless these are heated. (Berzelius, *Lehrb.*)

*Quadri*SULPHIDE OF MOLYBDENUM. $Mb S_4$ Insoluble in water. It is not decomposed by boiling water, or by acids. (Berzelius.) The compounds of $Mb S_4$ with the sulphides of potassium, sodium, lithium, and ammonium, are soluble in hot water; all others are insoluble.

*Di*SULPHIDE OF NICKEL. $Ni_2 S$ Soluble, with decomposition, in nitric acid, and slowly in strong chlorhydric acid, but is insoluble in hot dilute nitric acid. (Arfvedson.)

*Proto*SULPHIDE OF NICKEL.

a = $Ni S$ Soluble, with decomposition, in nitric acid, and aqua-regia. (Tupputi, *Ann. de Chim.*, 1811, **78.** 148.) Insoluble in chlorhydric or sulphuric acid.

When prepared in the dry way, it is insoluble in cold very dilute chlorhydric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **25.** 96.) When prepared by fusing oxide of nickel, or one of its compounds, with carbonate of soda and sulphur, a small portion of it dissolves in the sulphide of sodium on treating the mass with water. (H. Rose, *Tr.*)

b = *hydrated.* $Ni S, H O$ Insoluble in water. Sparingly soluble in ammonia-water, still more soluble in a mixture of sulphide of ammonium with caustic ammonia, but is insoluble in sulphide of ammonium, which has been thoroughly saturated with sulphuretted hydrogen. Very sparingly soluble in acetic acid, somewhat more soluble in chlorhydric acid, still more soluble in nitric acid, but most easily in aqua-regia. (Fresenius, *Quant.*, pp. 137, 760.) Not absolutely insoluble in sulphide of ammonium or the alkalies. It is not dissolved by dilute chlorhydric acid. (H. Rose, *Tr.*) While yet moist it is soluble in an aqueous solution of sulphurous acid. (Berthier.) Difficultly soluble in chlorhydric acid; very sparingly soluble in acetic acid; more abundantly soluble in ammonia, and in alkaline sulphides. After having been exposed to the air, and partially decomposed, it is perfectly insoluble in acetic acid, or sulphide of ammonium, and is only very sparingly soluble in dilute mineral acids. (Wackenroder.)

A solution of sulphuretted hydrogen does not produce any immediate precipitate in neutral solutions of nickel salts, unless the acid therein contained is a very feeble one, like acetic acid, but after the lapse of some time a trace of sulphide of nickel separates out; if the solution is acidified with a mineral acid, or even with acetic acid, no precipitate whatever is produced.

When recently precipitated it dissolves, with decomposition, in a warm aqueous solution of cyanide of potassium. (Haidlen & Fresenius.) The presence of non-volatile organic substances, like tartaric acid, does not prevent the precipitation of nickel by means of sulphide of ammonium. (H. Rose, *Tr.*)

*Bi*SULPHIDE OF NICKEL.
$Ni S_2$

SULPHIDE OF NITROBENZYLENE. *Vid.* Hydride of NitroSulphoBenzoyl.

SULPHIDE OF NITROGEN. $N S_2$ Insoluble in water. Slowly decomposes in moist air. Instantly decomposed by boiling water. Sparingly soluble in alcohol, ether, wood-spirit, and oil of turpentine. Its best solvent is bisulphide of carbon, 1 kilogramme of which dissolves about 15 grammes of it at the temperature of ebullition; this dissolution is accompanied with a very slight decomposition. It combines with the chlorides of sulphur. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **32.** 395.) Insoluble in water. Readily soluble in alcohol. (Gregory.) It is decomposed by cold water in the course of a few days; hot water soon decomposes it. Sparingly soluble in alcohol, more readily soluble in ether, especially when this is hot Soluble in absolute alcohol which contains caustic soda or sulphide of sodium in solution, but the solution thus obtained almost immediately undergoes decomposition. (Soubeiran.)

SULPHIDE OF OCTYL. *(Sulphide of Capryl. Capryl-Sulphydric Ether.)* $C_{32} H_{34} S_2 = \left.\begin{matrix} C_{16} H_{17} \\ C_{16} H_{17} \end{matrix}\right\} S_2$ Very sparingly soluble, or insoluble, in water. Very sparingly soluble in pure alcohol, and insoluble in alcohol which is charged with sulphide of sodium or sulphide (iodide?) of potassium. (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 137.

*Bi*SULPHIDE OF OSMIUM. $Os S_2$ Slightly soluble in water. No more soluble in alkaline solutions, and after having become dry, not at all soluble in alkalies. Soluble in nitric acid.

*Ter*SULPHIDE OF OSMIUM. $Os S_3$ Sparingly soluble in water. Soluble in nitric acid.

*Quadri*SULPHIDE OF OSMIUM. $Os S_4$ Sparingly soluble in water. Soluble in cold dilute nitric acid. Insoluble in aqueous solutions of the caustic or carbonated alkalies, or of the alkaline sulphides.

SULPHIDE OF PALLADIUM. $Pd S$ Insoluble in water, or in an aqueous solution of sulphide of ammonium. Soluble in chlorhydric acid. In presence even of 10000 pts. of water sulphide of palladium is precipitated, imparting a brown yellow color to the solution.

*Di*SULPHIDE OF PHOSPHORUS.
(Phosphorous HypoSulphide. HyposulphoPhosphorous Acid.)
$P_2 S$

I.) *Ordinary modif.* Unacted on by cold water from which air has been removed by boiling. Slowly decomposed when boiled with water. Insoluble in alcohol or ether, both of which, however, gradually decompose it, and dissolve the resulting products. Sparingly soluble in fixed and in volatile oils. Scarcely acted upon by weak, but decomposed by strong caustic potash or soda.

II.) *Red modif.* Unacted on by cold boiled water. When treated with cold nitric acid of 1.22 sp. gr. it is at first unacted upon, but at length suddenly combines with it with great violence. Weak acids act upon it only when hot.

*Proto*SULPHIDE OF PHOSPHORUS.
(Hypo Sulpho Phosphoric Acid. Phosphoric Hypo Sulphide.)
$P S$

I.) *Ordinary modif.* Unacted on by cold boiled water. Soluble in alcohol of 80%. (Bœttger, in *Gmelin*, **8.** 264.) Sparingly soluble in ether, the solution not being precipitated by water. Sparingly soluble in fixed and in volatile oils. Sparingly soluble in creosote (phenic acid). (Bœttger.) Soluble in bisulphide of carbon. (Corenwinder, *Ann. Ch. et Phys.*, (3.) **30.** 243.)

II.) *Red modif.* Unacted on by air or water. Slowly soluble, with decomposition, in caustic ammonia. Decomposed also by strong solutions of the fixed alkalies.

*Proto*SULPHIDE OF PHOSPHORUS (Red modif.), with *Di*SULPHIDE OF PHOSPHORUS (Red modif.). P_2S, PS Permanent. Soluble in boiling liquid protosulphide of phosphorus.

*Ter*SULPHIDE OF PHOSPHORUS. (*SulphoPhosphorous Acid. Phosphorous Sulphide.*) PS_3 Decomposes rapidly in moist air. Easily soluble, with decomposition, in solutions of caustic alkalies, or of ammonia, or of carbonate of potash, or carbonate of soda.

*Quinqui*SULPHIDE OF PHOSPHORUS. (*SulphoPhosphoric Acid. Phosphoric Sulphide.*) PS_5 Slowly soluble, with decomposition, in cold solutions of the alkaline carbonates. Extremely soluble in solutions of the caustic alkalies or of ammonia.

*Per*SULPHIDE OF PHOSPHORUS. PS_{12} Soluble in aqueous solutions of the caustic alkalies. (Berzelius.)

SULPHIDE OF PHOSPHORUS & OF POTASSIUM. $PS_3; 4KS_2$ Deliquescent. Soluble, with decomposition, in water. (H. Rose.)

SULPHIDE OF PHOSPHORUS & OF SILVER.

I.) = $PS_5; 2AgS$

II.) = $PS_3; 2AgS$ Readily soluble in nitric acid, with decomposition. (Berzelius.)

III.) = $PS_5; 2AgS$ (*SulphoPhosphate of Silver.*)

SULPHIDE OF PHOSPHORUS & OF ZINC. $P_3S_2; 2ZnS$ Soluble, with decomposition, in chlorhydric acid.

*Proto*SULPHIDE OF PLATINUM. PtS Permanent. Soluble in water. Scarcely attacked by boiling mineral acids. Not decomposed by aqua-regia, or potash-lye. (E. Davy.) Soluble in a large excess of an aqueous solution of sulphide of ammonium. Upon alcohol it acts like platinum-black, but much less strongly. (Bœttger.)

*Bi*SULPHIDE OF PLATINUM. PtS_2 Of the acids, aqua-regia alone exerts a slight action upon it. (E. Davy.) Fuming nitric acid also slowly decomposes it. (Berzelius.) Insoluble in chlorhydric acid; only slightly attacked by boiling nitric acid; soluble in hot aqua-regia. (Fresenius, *Qual.*) Soluble in aqueous solutions of the alkaline sulphides and carbonates, and in the caustic alkalies. (Berzelius.) Sulphide of platinum, precipitated by means of sulphide of ammonium, is soluble in a large excess of the latter, but is only very difficultly soluble. (Claus, *Beiträge*, p. 37.) Unacted upon by boiling concentrated chlorhydric, sulphuric, or nitric acid (of 1.2 sp. gr.), or by boiling aqueous solutions of caustic ammonia, or potash, of carbonate of soda, or sulphide of ammonium. (Bœttger.) Precipitated sulphide of platinum is insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) The limit of the reaction between sulphuretted hydrogen and a bisalt of platinum is in presence of 30000 pts. of water; the precipitate is soluble in chlorhydric acid. (Fischer.) 1 pt. of bichloride of platinum in 100 pts. of water mixed with 25 pts. of chlorhydric acid is not precipitated by sulphuretted hydrogen. (Reinsch.) [The compound above spoken of by Davy was prepared by fusing chloroplatinate of ammonium with sulphur; that of Bœttger, by decomposing an alcoholic solution of bichloride of platinum with bisulphide of carbon; while Berzelius's remarks refer to the ordinary precipitated sulphide.]

SULPHIDE OF PLATINUM & OF POTASSIUM.

SULPHIDE OF POTASSIUM.

I.) *mono.* KS Deliquescent. Very soluble in water, and in alcohol, though less so in the latter than in the former.

II.) *bi.* KS_2 Soluble in water, and alcohol.

III.) *ter.* KS_3 Decomposes in air. Easily soluble in water and in alcohol.

IV.) *quadri.* KS_4 Soluble in water, and alcohol.

V.) *quinqui.* KS_5 Hygroscopic. Soluble in all proportions in water, with production of cold. Readily soluble in alcohol.

All the sulphides of potassium are soluble in water, and those containing much sulphur are soluble in alcohol also. (Otto.) "Sulphide of potassium" is freely soluble in glycerin. (Parrish's *Pharm.*, p. 236.) It is insoluble in commercial acetate of ethyl. (Casaseca, *C. R.*, 1850, **30.** 821.)

"*Kali Sulphuratum*" is soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)

SULPHIDE OF POTASSIUM & OF SILICON. Entirely soluble in water. (Berzelius.)

SULPHIDE OF POTASSIUM & OF SILVER.

SULPHIDE OF POTASSIUM with SULPHOCYANIDE OF ALLYL.

I.) $KS; C_8H_5NS_2$ Soluble in alcohol.

II.) $2KS; C_8H_5NS_2$ More soluble in alcohol than No. I.

*Proto*SULPHIDE OF RHODIUM. RhS Insoluble in water.

*Sesqui*SULPHIDE OF RHODIUM. Rh_2S_3 Completely soluble in an aqueous solution of sulphide of potassium; partially soluble in a solution of caustic potash, with decomposition. (Berzelius.) Insoluble in a solution of sulphide of ammonium. (Berzelius.) Soluble in chlorhydric (Fischer), and nitric acid. (Descotils.)

SULPHIDE OF RUTHENIUM. Slightly soluble in sulphide of ammonium. Easily soluble in nitric acid.

SULPHIDE OF SELENIUM. Sulphur and selenium combine together in all proportions. The compound SeS_2 is easily soluble in aqueous solutions of the fixed caustic alkalies, and, with decomposition, in aqua-regia, also slowly in nitric acid, and in solutions of the alkaline sulphides after long-continued boiling.

SULPHIDE OF SILICON. SiS_3 Decomposed by moist air. Entirely soluble, with decomposition, in water. Alcohol and ether combine with it. (Fremy, *Ann. Ch. et Phys.*, (3.) **38.** 314.) Very quickly decomposed by water, with complete solution. (Berzelius.)

SULPHIDE OF SILVER. AgS When prepared in the moist way, it is insoluble in water, dilute acids, solutions of the caustic alkalies, or of the alkaline sulphides. Soluble in a solution of cyanide of potassium only when the latter is used in large excess. The small portion thus dissolved is reprecipitated, however, for the most part, by the addition of water. (Béchamp, cited by Fresenius, *Quant.*, p. 142.) Insoluble in an aqueous solution of cyanide of potassium. (Haidlen

& Fresenius.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Soluble in nitric acid. Decomposed by hot concentrated chlorhydric acid. Soluble in strong sulphuric acid, with decomposition. Insoluble in sulphurous acid. (Berthier.) Insoluble in an aqueous solution of protonitrate of mercury. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 317.) Insoluble in caustic ammonia, unless in presence of chloride of silver, when a portion of it ($Ag\,S$) is dissolved. (Gredy, *C. R.*, **14.** 757.) It is precipitated from solutions of silver salts containing only 1 pt. of the latter to 20000 pts. of water (Pfaff), to 35000 pts. of water. (Harting.) As separated from metallic silver, e. g. from coin, which frequently contains a little of it, it is very slowly dissolved by hot nitric acid, and is scarcely at all acted upon by it in the cold; it is easily dissolved, however, by adding concentrated sulphuric acid to the nitric acid used. (Gay-Lussac, *Ann. Ch. et Phys.*, **63.** 334.) Silver utensils, which have become covered with sulphide of silver, may be readily cleansed by placing them in contact with metallic zinc in a saturated boiling aqueous solution of borax, or a tolerably concentrated solution of caustic potash. (Bœttger.)

Sulphide of Sodium.

I.) *mono.*

a = $Na\,S$ Readily soluble in water. Alcohol precipitates it from the concentrated aqueous solution, but the precipitate redissolves when a larger amount of alcohol is added. (Berzelius, *Lehrb.*, **2.** 92.) Insoluble in alcohol or ether. (Roussin.) Insoluble in commercial acetate of ethyl. (Casaseca, *C. R.*, 1850, **30.** 821.)

b = *hydrated.* Decomposes in the air. Much $Na\,S + 9\,Aq$ less soluble in alcohol than in water, and may even be washed with the former. (Berzelius.)

II.) *bi.* $Na\,S_2$
III.) *tri.* $Na\,S_3$
IV.) *quadri.* $Na\,S_4$
Resemble the potassium compounds, so far as is known.

V.) *quinqui.* Soluble in water with reduction $Na\,S_5$ of temperature.

Sulphide of Sodium & of Tungsten. Insoluble in water. (Wœhler.) $Na\,S, 3\,W\,S_2$

Sulphide of StannEthyl. $\left.\begin{matrix} C_4\,H_5\,Sn \\ C_4\,H_5\,Sn \end{matrix}\right\}S_2$ Insoluble in water. Soluble in alcohol. (Cahours & Riche.) Insoluble in weak acids, or in ammonia-water; but soluble in strong chlorhydric acid, and in aqueous solutions of the fixed caustic alkalies and alkaline sulphides. (Frankland.)

Sulphide of Stib*tri*Amyl. Soluble in alcohol, and ether.

Sulphide of Stib*tri*Ethyl. Permanent. $Sb\left\{(C_4\,H_5)_3\,S_2\right.$ Readily soluble in water, and alcohol. Very sparingly soluble in cold, but readily soluble in warm ether. (Lœwig & Schweizer.)

Sulphide of StibEthylium. $\left.\begin{matrix} Sb\left\{(C_4\,H_5)_4\right. \\ Sb\left\{(C_4\,H_5)_4\right. \end{matrix}\right\}S_2$ Very easily soluble in water, and alcohol. (Lœwig.)

Sulphide of StibMethyl*tri*Ethylium. $\left.\begin{matrix} Sb\left\{\begin{matrix} C_2\,H_3 \\ (C_4\,H_5)_3 \end{matrix}\right. \\ Sb\left\{\begin{matrix} C_2\,H_3 \\ (C_4\,H_5)_3 \end{matrix}\right. \end{matrix}\right\}S_2$ Readily soluble in water, and alcohol. (Friedlænder.)

Sulphide of StibMethylium. $\left.\begin{matrix} Sb\left\{(C_2\,H_3)_4\right. \\ Sb\left\{(C_2\,H_3)_4\right. \end{matrix}\right\}S_2$ Decomposes when exposed to the air. Very easily soluble in water, and alcohol. Insoluble in ether.

Sulphide of Stilbene. *Vid.* Hydride of SulphoBenzoyl.

Sulphide of Strontium.

I.) *mono.* Soluble in water, with decomposition. $Sr\,S$

II.) *ter.* Resembles the corresponding barium compound. $Sr\,S_3$

*Bi*Sulphide of SulphoCarb(onyl)Ammonium. (*Hydranzothin. CarboSulphamid. Sulfocyanogène Bihydrosulfurée.*) $C_2\,H_2\,N\,S_4 = N\left\{\begin{matrix} C_2\,S_2'' \\ H_2 \end{matrix}\right., S_2$ Very sparingly soluble in cold, decomposed by boiling water. Soluble in cold alcohol, without alteration, but the solution is decomposed on boiling. Water precipitates it from the alcoholic solution. More soluble in ether than in alcohol. On evaporating the ethereal solution a portion of the substance is decomposed. With acetone it behaves as with ether. Decomposed by alkalies. Not sensibly acted on by sulphuric or chlorhydric acid. (Zeise, *Ann. Ch. et Phys.*, (3.) **9.** 125.)

*Per*Sulphide of *di*SulphoCarbonate of Ethyl. *Vid. Bi*OxySulphoCarbonate of Ethyl.

Sulphide of Tantalum. Insoluble in water. Unacted upon by chlorhydric acid, or by most of the other acids. Slowly decomposed by boiling nitric acid, and by aqua-regia. Sulphuric or fluorhydric acids have scarcely any action upon it. A mixture of nitric and fluorhydric acids decomposes it. Unacted upon by potash-lye. (H. Rose.)

Sulphide of TellurEthyl. $\left.\begin{matrix} C_4\,H_5\,Te \\ C_4\,H_5\,Te \end{matrix}\right\}S_2$

*Bi*Sulphide of Tellurium. (*Sulpho Tellurous Acid.*) $Te\,S_2$ Sulphur and tellurium may be melted together in all proportions. Of these compounds, $Te\,S_2$ is soluble in a boiling aqueous solution of caustic potash. While still moist, it is soluble in a concentrated solution of caustic ammonia, but is scarcely at all acted upon by a dilute solution. Soluble, with combination, in boiling aqueous solutions of the alkaline sulphides.

*Ter*Sulphide of Tellurium. Ppt. $Te\,S_3$

Sulphide of Thorium. When treated with $Th\,S$ acids, a faint odor of sulphuretted hydrogen is at first evolved, but the sulphide does not appear to be dissolved to a perceptible extent, even when the acid is warm; even nitric acid attacks it but slightly. Unacted upon by cold aqua-regia, but hot aqua-regia dissolves it completely, sulphate of thoria being formed. (Berzelius, *Pogg. Ann.*, 1829, **16.** 402.)

*Proto*Sulphide of Tin.

a = $Sn\,S$ Soluble, with decomposition, in concentrated chlorhydric acid. Insoluble in an aqueous solution of potash. (Proust.)

b = *hydrated.* Insoluble in water, sulphuretted $Sn\,S, H\,O$ hydrogen water, or dilute acids. Soluble, with decomposition, in the stronger acids; easily in hot concentrated chlorhydric acid. Insoluble in caustic ammonia.

Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Tolerably readily soluble (as bisulphide) in solutions of yellow sulphide of ammonium (H. Rose), or yellow sulphide of potassium.

Completely insoluble in colorless sulphide of ammonium, i. e. in that which contains no excess of sulphur. Precipitated sulphide of tin generally dissolves in ordinary sulphide of ammonium, but a very large excess of the latter is required, and this is so much the greater in proportion as the solution is less strongly colored with sulphur. The rapidity of solution may be very much increased by adding a little pulverized sulphur, and heating. (H. Rose, *Tr.*) Insoluble in sulphurous acid. (Berthier.)

*Sesqui*Sulphide of Tin. Partially soluble, $Sn_2 S_3$ with decomposition, in caustic potash, and concentrated chlorhydric acid.

*Bi*Sulphide of Tin.
(*Sulpho Stannic Acid.*)

a = $Sn S_2$ Soluble in hot solutions of caustic or carbonated potash, also in hot solutions of the sulphides of ammonium, sodium, and potassium. Sublimed bisulphide of tin is insoluble in chlorhydric acid, &c., but is dissolved by aqua-regia.

b = *hydrated.* Insoluble in water, sparingly $Sn S_2, H O$ soluble in water which contains sulphuretted hydrogen. Difficultly soluble in caustic ammonia. Easily soluble in solutions of caustic potash, and of the alkaline sulphides; also in hot concentrated chlorhydric acid. (Fresenius, *Quant.*, p. 155.) Soluble in aqueous solutions of caustic potash, caustic ammonia, and the alkaline carbonates, though less readily than the tersulphide of arsenic. Unlike the sulphide prepared in the dry way, it is soluble, with decomposition, in hot concentrated chlorhydric acid. (H. Rose, *Tr.*) More readily soluble than the anhydrous sulphide in solutions of the alkaline sulphides, or caustic alkalies, also of carbonate of potash.

Insoluble in aqueous solutions of chloride of ammonium, and nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) Sulphuretted hydrogen ceases to precipitate tin when 120000 pts. of water are present. (Pfaff.)

*Bi*Sulphide of Titanium. Insoluble in $Ti S_2$ water, or in chlorhydric or sulphuric acid. Soluble, with decomposition, in aqua-regia. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **20.** 394.) Slowly soluble in acids. Decomposed, with partial solution, by caustic alkalies. Insoluble in alkaline sulphides. (H. Rose.)

*Bi*Sulphide of Tungsten. Completely in- $W S_2$ soluble in water. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 27.) Decomposed by aqua-regia. (Berzelius.)

*Ter*Sulphide of Tungsten. *Vid.* Sulpho- $W S_3$ Tungstic Acid.

*Proto*Sulphide of Uranium. Insoluble in $Ur S$ water. When prepared in the dry way, it is only slightly acted upon by chlorhydric acid. Decomposed by nitric acid at the ordinary temperature. When prepared by precipitation in the moist way, it appears to be slightly soluble in water, and is somewhat soluble in aqueous solutions of the alkaline sulphides. (Berzelius, *Lehrb.*, **2.** 738.)

*Bi*Sulphide of Vanadium. When prepared $V S_2$ in the dry way, it is insoluble in sulphuric or chlorhydric acids, or in aqueous solutions of the caustic alkalies, but is decomposed by nitric acid. As prepared in the moist way, it is insoluble in water, but soluble, with combination, in aqueous solutions of the alkaline sulphides, and sparingly soluble in solutions of the sulphides of the alkaline earths, also soluble in aqueous solutions of the caustic and boiling carbonated alkalies, and of boracic acid. Not decomposed by chlorhydric or sulphuric acid.

*Ter*Sulphide of Vanadium. Insoluble in $V S_3$ water. Soluble in aqueous solutions of the caustic, carbonated, and sulphuretted alkalies. It is not decomposed by sulphuric acid. [*Vid.* also SulphoVanadiate of *X.*]

Sulphide of Xanthene. Insoluble in water, "$C_3 H_2 N_2 S_2$" alcohol, or ether. Easily soluble in alkaline solutions. Unacted upon by dilute acids. (Vœlckel.)

Sulphide of Xuthene. Insoluble in water, "$C_{10} H_7 N_9 S_4$" alcohol, or ether. (Vœlckel.)

Sulphide of Yttrium. Insoluble in water. $Y S$ (Wœhler.) Decomposed by acids.

Sulphide of Zinc.

a = *anhydrous.* Insoluble in water. Less $Zn S$ readily soluble in acids than the hydrate. When prepared in the dry way, it is still soluble in cold dilute chlorhydric acid, but is insoluble in acetic acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **25.** 97.) Only very slowly soluble in concentrated chlorhydric acid. As it occurs in nature (Blende), it is only slightly attacked by acids, excepting aqua-regia. (Berzelius, *Lehrb.*) When heated with a solution of sulphuretted hydrogen in a sealed tube it dissolves with tolerable facility. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 168.)

b = *hydrated* [as ordinarily precipitated]. In- $Zn S, H O$ soluble in water, in solutions of caustic or carbonated alkalies, or of the alkaline sulphides. Insoluble in solutions of caustic ammonia, or of its carbonate. Easily soluble, even in very dilute chlorhydric and nitric acids. It may, however, be precipitated by sulphuretted hydrogen from solutions acidulated with chlorhydric or sulphuric acid, especially if a large amount of water be present. [Compare a discussion of the observed facts, by Eliot & Storer, *Mem. Amer. Acad.*, (N. S.) **8.** 95]. Difficultly soluble, and only when heated, in concentrated chlorhydric acid. (Berzelius, *Lehrb.*, **2.** 650.) More easily soluble in nitric than chlorhydric acid. (Fresenius, *Qual.*) Slightly soluble in acetic acid. (Wackenroder.) While still moist it is soluble in an aqueous solution of sulphurous acid. (Berthier.) Insoluble in aqueous solutions of chloride of ammonium, or nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 99.) A solution of sulphide of potassium, when added to a solution of sulphate of zinc, produces a precipitate in the presence of 10000 pts. of water; there is still a slight opalescence in presence of 20000 pts. of water. (Lassaigne.)

Sulphide of Zirconium. Insoluble in wa- $Zr_2 S_3$ ter, or in sulphuric, nitric, or chlorhydric acid. Slowly attacked by boiling aqua-regia. Easily soluble in fluorhydric acid. Unacted upon by potash-lye.

*Bi*SulphiMethylic Acid. *Vid.* Methyl-Sulphurous Acid.

Sulphimid. *Vid.* Sulphurylamin.

SulphIndigotic Acid. Absorbs water from the air. Very readily soluble in water; also readily soluble in alcohol. The alkaline

(*Sulphate of Indigo. Sulph Indylic Acid. Cerulo Sulphuric Acid. Soluble Indigo Blue.*)

$$C_{16} H_5 N S_2 O_8 = N \left\{ \begin{matrix} C_{16} H_4 O_2'' \\ S_2 O_4'' \end{matrix} \right. . O, H O$$

salts of sulphindigotic acid are sparingly soluble in cold, more readily soluble in boiling water; they are insoluble in alcohol, and in aqueous solutions of other alkaline salts.

SulphIndigotate of Alumina.

I.) Readily soluble in water. (Berzelius.)

II.) *basic.* Ppt.

SulphIndigotate of Ammonia. Soluble in 40 @ 50 pts. of cold, and in a much smaller quantity of hot water. (Crum.) From this solution it is precipitated on the addition of alkaline sulphates, and by some other salts, but much less completely than the potash salt. It is not soluble in alcohol. (Berzelius; Crum.)

SulphIndigotate of Baryta. Slightly soluble in cold, somewhat soluble in hot water.

$C_{16}\,H_4\,Ba\,N\,S_2\,O_8$

SulphIndigotate of Lead.

I.) Sparingly soluble in water.

II.) *basic.*

SulphIndigotate of Lime. More readily soluble than sulphate of lime in water. Insoluble in alcohol. (Berzelius.)

SulphIndigotate of Magnesia. Readily soluble in water. Insoluble in alcohol. (Berzelius.)

SulphIndigotate of Potash. Deliquescent. Soluble in 140 pts. of cold water; more easily soluble in boiling water. Insoluble in alcohol of 0.84 sp. gr. (Berzelius.) Water which contains one percent of acetate of potash does not dissolve it in the cold; when heat is applied a portion dissolves, but it separates out again as the solution cools. Insoluble in concentrated chlorhydric, but readily soluble in concentrated sulphuric acid. (Crum.)

(*Precipitated Indigo. Soluble Indigo. Indigo Carmine. Carmine Blue.*)
$C_{16}\,H_4\,K\,N\,S_2\,O_8$

SulphIndigotate of Soda. Insoluble, or very sparingly soluble, in water which contains 2% of acetate of soda. When dissolved in hot water containing a soda salt in solution, the greater part of it separates out again on cooling. It is less completely precipitated from the aqueous solution, on the addition of other salts than the sulphindigotate of potash. (Crum.)

SulphIndylic Acid. *Vid.* SulphIndigotic Acid.

SulphIsatanous Acid. Soluble in water. (Laurent.)

(*Sulphite of Indylium.*)
$C_{16}\,H_7\,N\,S_2\,O_8$

SulphIsatanite of Ammonia. Very soluble in water; slightly less soluble in alcohol. (Laurent.)

$C_{16}\,H_6\,(N\,H_4)\,S_2\,O_8 + 2\,Aq$

Sulphisatyde. Insoluble in water. Boiling alcohol dissolves only traces. which separate out on cooling. It is not more soluble in ether than in alcohol. (Laurent.)

(*Sulphasatyde.*)
$C_{32}\,H_{12}\,S_2\,N_2\,O_6$

***Bi*Sulphisatyde.** Insoluble in boiling water. Very readily soluble in warm alcohol, and ether. Soluble in strong sulphuric acid, and in potash-lye.

(*Sulphisatin. Sulphesathyde.*)
$C_{32}\,H_{12}\,S_4\,N_2\,O_4$

SulphiteAmmon. *Vid.* Sulphurylamin.

Sulphurous Acid.

$S\,O_2$

I.) *gaseous.* 1 vol. of water absorbs 30 vols. of $S\,O_2$ gas at 18° (Davy); about 20 vols. at the ordinary temperature (Dalton, in his *New System*, Pt. **2.** p. 389); 43.78 vols. (Saussure); about 50 vols. at 20°, and a barometric pressure of 76mm. (P. & F.); 33 vols. at the ordinary temperature. (T. Thomson, in his *New System of Chem.*, London, 1831, **2.** 38.)

1 pt. by weight of it is soluble in 0.1429 (= $\frac{1}{7}$) pt. of water at 5°, and the solution obtained is of 1.020 sp. gr. (Fourcroy & Vauquelin); in 0.0400 (= $\frac{1}{25}$) pt. of water at the ordinary temperature (Priestley); in 0.0909 ($\frac{1}{11}$) pt. of water at 16°, and the sp. gr. of the solution obtained = 1.0513. (Thomson.) Soluble in 2 pts. of water of 10°. (Pierre, *Ann. Ch. et Phys.*, (3.) **23.** 421.)

At 18° C., and the ordinary pressure, 100 vols. of	Absorb vols. of $S\,O_2$.
Water free from air	4378
Alcohol of 0.84 sp. gr.	11577

(Th. de Saussure, Gilbert's *Ann. der Phys.*, 1814, **47.** 167.) Soluble in ether.

At °C.	1 vol. of a saturated aqueous solution of sulphurous acid contains of $S\,O_2$ gas: Vols. reduced to 0° and 0m. 76 barometric pressure.	1 vol. of water under a pressure of 0m.76 of mercury, dissolves of $S\,O_2$ gas: Vols. reduced to 0° and 0m. 76 barometric pressure.
0°	68.861	79.789
1°	67.003	77.210
2°	65.169	74.691
3°	63.360	72.230
4°	61.576	69.828
5°	59.816	67.485
6°	58.080	65.200
7°	56.369	62.973
8°	54.683	60.805
9°	53.021	58.697
10°	51.383	56.647
11°	49.770	54.655
12°	48.182	52.723
13°	46.618	50.849
14°	45.079	49 033
15°	43.564	47.276
16°	42.073	45.578
17°	40.608	43.939
18°	39.165	42.360
19°	37.749	40.838
20°	36.206	39.374
21°	34.986	37.970
22°	33.910	36.617
23°	32.847	35.302
24°	31.800	34.026
25°	30.766	32.786
26°	29.748	31.584
27°	28.744	30.422
28°	27.754	29.314
29°	26.788	28.210
30°	25.819	27.161
31°	24.873	26.151
32°	23.942	25.178
33°	23.025	24.244
34°	22.122	23.347
35°	21.234	22.489
36°	20.361	21.668
37°	19.502	20.886
38°	18.658	20.141
39°	17.827	19.435
40°	17.013	18.766

(Schœnfeld, *Ann. Ch. u. Pharm.*, **95.** pp. 5, 7, and fig.)

When mixed with hydrogen, or with carbonic acid gas, sulphurous acid gas is absorbed by water as readily as when it is pure, i. e. it obeys Dalton's law of absorption even when these gases are present. (Schœnfeld, *Ann. Ch. u. Pharm.*, **95.** 12.)

Solubility of S O_2 in Water at 7°, — under various Pressures, — by Experiment.

P*	G* at P	G at 760mm.
27.0	0.010	0.273
49.8	0.015	0.224
89.6	0.025	0.208
133.7	0.035	0.196
239.0	0.059	0.189
741.8	0.173	0.177
757.1	0.174	0.174
770.8	0.178	0.176
986.3	0.228	0.175
1291.0	0.293	0.172

* P = "Partial pressure," i. e. the total pressure, minus the tension of aqueous vapor at the given temperature. G = Weight of S O_2, in grammes, which is dissolved in 1 gramme of water at the pressure P V = The volume of G grammes of S O_2 at 0° aud $0^m.760$. The third column "(G at 0m.760)" indicates how much S O_2 would be contained in 1 gramme of water at 0m.760, if the absorption were proportional to the pressure.

The following table is calculated from the experimental results above given.

P.	G at P.	G at 760mm.	V at P.	V at 760mm.
30	0.010	0.263	3.634	92 06
40	0.013	0.242	4.451	84.55
50	0.015	0.223	5.129	77.95
60	0.017	0.218	6.024	76.28
70	0.020	0.213	6.868	74.55
80	0.022	0.210	7.743	73.55
90	0.025	0.208	8.598	72.62
100	0.027	0.205	9.421	71.60
120	0.032	0.201	11.09	70 20
140	0.036	0.197	12 71	69.00
160	0.041	0.195	14.34	68.15
180	0.046	0.193	15.97	67.40
200	0.050	0.191	17.59	66.83
220	0.055	0.190	19.19	66.30
240	0.059	0.188	20.79	65.84
260	0.064	0.187	22.40	65.44
280	0.069	0.186	23.99	65.10
300	0.073	0.185	25.59	64.81
350	0.085	0.184	29.55	64.16
400	0.096	0.182	33.51	63.65
450	0.107	0.181	37.44	63.25
500	0.118	0.180	41.42	62.94
550	0.130	0.179	45.31	62.60
600	0.141	0.178	49.20	62.32
650	0 152	0.178	53.10	62.09
700	0.163	0.177	56.98	61.86
750	0.174	0.176	60.88	61.69
760	0.176	0.176	61.65	61.65
800	0.185	0.176	64.74	61.50
850	0.196	0.175	68.57	61.30
900	0.207	0.175	72.41	61.15
950	0.218	0.175	76.25	61.00
1000	0.229	0.174	80.01	60.88
1050	0.240	0.174	83.97	60.77
1100	0.251	0.174	87.80	60.65
1200	0.273	0.173	95.45	60.45
1300	0.295	0.172	103.00	60.25

(Sims, *Ann. Ch. u. Pharm.*, 1861, **118.** 340.)

Solubility of S O_2 *in Water, at 20°, — at various Pressures, — by Experiment.*

P.	G at P.	G at 0m.760.
32.4	0.006	0.148
50 1	0.009	0.138
65.0	0.011	0.133
77.3	0.013	0.127
78.4	0.013	0.129
82.2	0.014	0.126
121.8	0.020	0 113
291.0	0.043	0.111
446.6	0.064	0.109
658.2	0.094	0.108
728.9	0.100	0.104
729.5	0.100	0.104
730 8	0.100	0.104
1570.0	0.218	0.105
1911.0	0.260	0.104

The following table (for 20°) is calculated from the experimental results above given.

P.	G at P.	G at 0m.760.	V at P.	V at 0m.760.
40	0.007	0.143	2.637	50.09
50	0.009	0.138	3.171	48.20
60	0.011	0.135	3.718	47.10
70	0.012	0.131	4.205	45.64
80	0.013	0.127	4.663	44.30
90	0.015	0.125	5.169	43.65
100	0.016	0.124	5.692	43.25
120	0.019	0.121	6.683	42.33
140	0.022	0.119	7.690	41.75
160	0.025	0.118	8.666	41.17
180	0.028	0.117	9.652	40.75
200	0.030	0.116	10.62	40.35
220	0.033	0.115	11.59	40.03
240	0.036	0.114	12.54	39.70
260	0.038	0.112	13.45	39.30
280	0.041	0.112	14.41	39.10
300	0.044	0.111	15.34	38.87
350	0.050	0.110	17.66	38.35
400	0.059	0.109	20.56	38.10
450	0.064	0.108	22.37	37.77
500	0.071	0.107	24.67	37.50
550	0.077	0.106	26.93	37.20
600	0.083	0.105	29.14	36.90
650	0.090	0.105	31.39	36.70
700	0.096	0.105	33.62	36.50
750	0.103	0.104	35.94	36.43
760	0.104	0 104	36.43	36.43
800	0.110	0.104	38.32	36.40
1000	0.137	0.104	47.85	36.37
1300	0.178	0.104	62.10	36.31
1600	0.218	0.104	76.35	36.27
1900	0.259	0.104	90.53	36.21

Solubility of S O_2 *in Water at 39.8°, — at various Pressures, — by Experiment.*

P.	G at P.	G at 0m.760.
205.9	0.017	0.062
293.1	0.023	0.060
696.0	0.054	0.059
697.6	0.054	0.059
701.6	0.053	0.055
1565.0	0.116	0.056
2021.0	0.150	0.056

The following table (for 39.8°) is calculated from the experimental results above given.

P.	G at P.	G at 0m.760.	V at P.	V at 0m.760.
200	0.016	0.062	5.675	21.57
300	0.024	0.061	8.368	21.20
400	0.031	0.060	11.03	20.95
500	0.039	0.059	13.67	20.77
600	0.047	0 059	16.29	20.64
760	0.059	0.059	20.50	20.50
800	0.062	0.059	21.58	20 50
1000	0.077	0.058	26.84	20.40
1500	0.113	0.057	39.65	20.09
2000	0.149	0.057	52.11	19.80

Solubility of S O_2 *in Water at 50°, — at various Pressures, — by Experiment.*

P.	G at P.	G at 0m.760.
191.5	0.011	0.011
664.0	0.039	0.039
1961.1	0.115	0.120

The following table is calculated from the experimental results above given.

P.	G at P.	G at 0m.760.	V at P.	V at 0m.760.
200	0.012	0.045	4.156	15.97
400	0.024	0.045	8.275	15.72
600	0.035	0.045	12.36	15.65
760	0.045	0.045	15.62	15.62
800	0.047	0.045	16.43	15.60
1000	0.059	0.045	20.51	15.59
1500	0.088	0.044	30.73	15.57
2000	0.112	0.044	39.07	15.55

The following table of the *Solubility of* SO_2 *at various Temperatures, under a Pressure of* $0^m.760$ *of Mercury, is deduced from the foregoing.*

At °C.	G.	V.	At 0°.	G.	V.
8°	0.168	58.7	30°	0.078	27.3
10°	0.154	53.9	32°	0.073	25.7
12°	0.142	49.6	34°	0.069	24.3
14°	0.130	45.6	36°	0.065	22.8
16°	0.121	42.2	38°	0.062	21.6
18°	0.112	39.3	40°	0.058	20.4
20°	0.104	36.4	42°	0.055	19.3
22°	0.098	34.2	44°	0.053	18.4
24°	0.092	32.3	46°	0.050	17.4
26°	0.087	30.5	48°	0.047	16.4
28°	0.083	28.9	50°	0.045	15.6

With regard to this table Sims remarks: "These numbers do not agree closely with those of Schœnfeldt. The differences are sufficiently explained, however, by the different methods employed, by the fact that Schœnfeldt did not allow for the tension of aqueous vapor, and by the corrections employed by him under the assumption that Dalton's law is correct."

As a result of his research, Sims finds that in proportion as the temperature is higher, so much the more nearly does the solubility of SO_2 in water conform to Dalton's law, so that, in general terms, it may be said, that it obeys this law for temperatures above 40°. (Sims, *Ann. Ch. u. Pharm.*, 1861, **118.** pp. 340–344, and fig.) The saturated aqueous solution is of 1.040 sp. gr. (Berthollet.)

An aqueous solution saturated at
0° is of 1.06091 sp. gr.
10° " 1.05472 "
20° " 1.02386 "
40° " 0.95548 "

(Schœnfeld, *Ann. Ch. u. Pharm.*, **95.** 7.)

From these observations, cited by Bunsen in his *Gasometry*, Schiff calculates the following table, by means of the formulæ: Between 1° and 10°: $1.0607 - 0.0012\,t + 0.0006\,t^2$. Between 1° and 20°: $1.0605 + 0.00067\,t - 0.000125\,t^2$.

An aqueous solution saturated at °C.	Is of sp. gr.	An aqueous solution saturated at °C.	Is of sp. gr.
0°	1.0609	13°	1.0481
1°	1.0596	14°	1.0454
2°	1.0585	15°	1.0424
3°	1.0576	16°	1.0392
4°	1.0569	17°	1.0358
5°	1.0562	18°	1.0321
6°	1.0557	19°	1.0281
7°	1.0552	20°	1.0239
8°	1.0549	21°	1.0195
9°	1.0548	22°	1.0147
10°	1.0547	23°	1.0099
11°	1.0528	24°	0.9991
12°	1.0505		

Schiff also calculates the following table, by means of the formula: $D = 1 + 0.0023993\,p + 0.00003911\,p^2 - 0.00000013302\,p^3$; in which D = the sp. gr. of the solution and p the percentage of acid in the solution.

Sp. gr.	Percent of SO_2.	Sp. gr.	Percent of SO_2.
1.0024	1	1.0343	12
1.0049	2	1.0376	13
1.0075	3	1.0410	14
1.0102	4	1.0445	15
1.0130	5	1.0480	16
1.0158	6	1.0517	17
1.0187	7	1.0553	18
1.0217	8	1.0591	19
1.0247	9	1.0629	20
1.0278	10	1.0667	21
1.0311	11		

(H. Schiff, *Ann. Ch. u. Pharm.*, 1858, **107.** pp. 311, 312.)

1 vol. of alcohol, under a pressure of 0m. 76 of mercury, at °C.	Dissolves of SO_2 gas: vols. reduced to 0 °C. and 0m.76 pressure of mercury.
0°	328.62
1°	311.98
2°	295.97
3°	280.58
4°	265.81
5°	251.67
6°	238.16
7°	225.25
8°	212.98
9°	201.33
10°	190.31
11°	179.91
12°	170.13
13°	160.98
14°	152.45
15°	144.55
16°	137.27
17°	130.61
18°	124.58
19°	119.17
20°	114.48
21°	110.22
22°	106.68
23°	103.77
24°	101.47

(Bunsen's *Gasometry*, pp. 289, 128, 164.)

Oil of turpentine absorbs a considerable quantity of it. (T.) Sulphurous acid is absorbed by oil of turpentine with great rise of temperature, the oil turning light yellow, remaining mobile, and acquiring the odor of the acid. (Gehlen.) Sulphurous acid is rapidly absorbed by anhydrous aldehyde in the cold, 11 pts. of aldehyde absorbing 19 pts. of the acid. The absorption coefficient of aldehyde for SO_2 is 1.4 times greater than that of alcohol, and 7 times as great as that of water. (Geuther & Cartmell, in *Gm.*, from *Proc. Roy. Soc.*, **10.** 111.)

b = hydrated. Crystallizes out at 0°; but melts again at + 3.4°. Easily soluble in water, much less soluble in alcohol. Soluble in an aqueous solution of sulphurous acid, from which, if it be concentrated, it crystallizes out on cooling. (Pierre, *Ann. Ch. et Phys.*, (3.) **23.** 421.)

$SO_2 + 15\,Aq$ (Schœnfeld)

Only the alkaline normal salts of sulphurous acid are soluble in water, and they are all insoluble, or but sparingly soluble, in alcohol. The acid salts are soluble in water.

Sulphite of AcetoneAmmonium. Easily soluble in water, and alcohol. Insoluble in ether. (Stædeler.)

(*Sulphite of MesitylAmmonium.*)
$C_6H_8(NH_4)O_2, 2SO_2 + 2Aq$

Sulphite of AcetonePotassium.
(*Sulphite of MesitylPotassium.*)
$C_6 H_5 K O_2, 2 S O_2 + Aq$
Tolerably soluble in water, more difficultly soluble in alcohol. (Limpricht, *Ann. Ch. u. Pharm.*, **93.** 239.)

Sulphite of AcetoneSodium.
(*Sulphite of MesitylSodium.*)
$C_6 H_5 Na O_2, 2 S O_2 + 2 Aq$
Tolerably soluble in water, more difficultly soluble in spirit. (Limpricht, *loc. cit.*)

Sulphite of Acetylammonium.
(*BiSulphite of Aldehyde Ammonia. Isomeric with Taurin.*)
$C_4 H_7 N S_2 O_6 = C_4 H_3 (N H_4) O_2, 2 S O_2$
Very soluble in water. Soluble in weak alcohol; difficultly soluble in absolute alcohol, or in ether. (Redtenbacher.)

Petersen (*Ann. Ch. u. Pharm.*, **102.** 325) has observed a modification of this substance, which is much less soluble in water, especially in cold water, than Redtenbacher's compound. Scarcely at all soluble in alcohol, and ether.

*Bi*Sulphite of Aldehydeammonia.
$N H_3, C_4 H_4 O_2 + 2 S O_2$
Vid. Sulphite of Acetylammonium.

Sulphite of Alloxan & of Potash.
$C_8 H_5 N_2 K S_2 O_{16} = C_8 H_2 N_2 O_8, K O, 2 S O_2 + 3 Aq$
Rather difficultly soluble in cold, but easily soluble in boiling water.

Sulphite of Alumina.

I.) *basic.*
$Al_2 O_3, S O_2 + 4 Aq$
Insoluble in water. Soluble in sulphurous acid. (Fourcroy & Vauquelin.)

II.) "*normal.*" Decomposes in the air. Soluble in water, but the solution is decomposed on boiling. (Gougginsperg.) Moist hydrate of alumina is soluble in sulphurous acid, but is completely reprecipitated, as hydrate, on boiling the solution. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 75.)

"Sulphite of Ammon," &c.
(Compounds of $N H_3$ & $S O_2$)
Vid. Sulphurylamid.

Sulphite of Ammonia.

I.) *mono.*
$N H_4 O, S O_2$
Hygroscopic. Soluble in 1 pt. of water at 12°, with considerable reduction of temperature; much more soluble in hot water, but ammonia is evolved when the solution is boiled. (Fourcroy.) Sparingly soluble in absolute alcohol. (Muspratt.) Much more soluble than sulphite of potash. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **36.** 83.)

II.) $2 (N H_4 O, S O_2) + 3 Aq$

III.) *bi.*
$N H_4 O, 2 S O_2$
Decomposes when exposed to the air. Easily soluble in water. Very soluble in alcohol. Insoluble in ether. (Muspratt.)

Sulphite of Ammonia & of Cadmium.
$N H_4 O, S O_2; Cd O, S O_2$
Exceedingly sparingly soluble in water, scarcely a trace being dissolved therein, even on boiling. Somewhat soluble at the ordinary temperature in sulphurous acid, but is reprecipitated on boiling. More soluble when in presence of the corresponding zinc salt than in pure water. (Schueler, *Ann. Ch. u. Pharm.*, **87.** 45.)

Sulphite of Ammonia & *of dinoxide* of Copper.

I.) $N H_4 O, S O_2; Cu_2 O, S O_2$
Insoluble in water, or in weak acids. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **42.** 30.) Decomposed by boiling with water. (Rogojski.)

II.) $2 (Cu_2 O, S O_2); N H_4 O, S O_2 + 3 Aq$
Decomposed when heated in water. (Muspratt.)

III.) $7 (N H_4 O, S O_2); Cu_2 O, S O_2 + 10 Aq$
Rapidly decomposed in the air. Somewhat soluble in warm, less soluble in cold water. (Péan de St. Gilles, *Ibid.*)

Sulphite of Ammonia, *of dinoxide* of Copper, & *of protoxide* of Copper.
$N H_4 O, S O_2, 2 (Cu_2 O, S O_2); Cu O, S O_2 + 5 Aq$
Insoluble in water, but is decomposed when boiled therewith. Insoluble in weak acids; but is decomposed when left in contact with acid liquors. Soluble in ammonia-water. (*Idem*, *Ibid.*)

Sulphite of Ammonia & of Magnesia.
$N H_4 O, S O_2; 3 (Mg O, S O_2 + 5 Aq)$
Very sparingly soluble in water. (Fourcroy & Vauquelin.) Soluble in sulphurous acid.

Sulphite of Ammonia & Nitric Oxide.
(*NitroSulphate of Ammonia.*)
$N H_4 O, N O_2, S O_2$
Gradually deliquescent, with decomposition. Soluble in water at first without decomposition, but subsequently decomposes the more rapidly the higher the temperature. Less soluble in an aqueous solution of ammonia than in pure water, but the solution thus obtained decomposes much more slowly. (Pelouze.) Insoluble in hot alcohol. Alcohol precipitates it from the aqueous solution. (Pelouze.)

Sulphite of Ammonia & of Platin(*ous*)*bi*amin.

I.) (Prepared from the green modif. (γ) of chloride of platin(ous)ammonium [see p. 174.].)

$a = N H_4 O, S O_2; N_2 \left\{ H_6 . Pt' O, H O, 2 S O_2 \right.$
Separates from its alcoholic solution after a time. (Peyrone, *Ann. Ch. u. Pharm.*, **61.** 179.)

$b =$ *With excess of sulphite of ammonia?* Soluble in all proportions in water, from which oily drops are precipitated on the addition of alcohol. (Peyrone, *loc. cit.*)

II.) (Prepared from the orange modif. (δ) of chloride of platin(ous) ammonium.)

$a = 2 (N H_4 O, S O_2); N_2 \left\{ H_6 . Pt' O, H O, 2 S O_2 \right.$
Soluble in all proportions in water, from which it is precipitated in oily drops on the addition of alcohol. (Peyrone, *Ann. Ch. u. Pharm.*, **61.** 179.)

Sulphite of Ammonia & of Platinum.
$N H_4 O, S O_2; Pt O, S O_2 + Aq$
Easily soluble in water. Insoluble in strong alcohol. (Liebig.)

Sulphite of Ammonia & of Silver.

Sulphite of Ammonia & of Zinc. Soluble in water.

Sulphite of Anilin.

Sulphite of Anisicyl("Anisyl")Ammonium. Readily soluble in water. Sparingly soluble in aqueous solutions of the bisulphites. (Bertagnini.)

Sulphite of AnisicylPotassium. Readily soluble in pure water, less soluble in water charged with sulphites. Soluble in dilute alcohol. (Bertagnini.)

Sulphite of AnisicylSodium.
$C_{16} H_7 Na O_4, 2 S O_2 + 2 Aq$
Soluble in cold water, but the solution is decomposed on ebullition; less soluble in water which contains

a little sulphite of soda; and nearly insoluble in a saturated cold solution of sulphite of soda, but is somewhat soluble in the same when warm. Soluble in boiling, less soluble in cold alcohol. (Bertagnini.)

Sulphite *of teroxide* of Antimony. Insoluble in water. (Berzelius.)
$SbO_3, 3SO_2$

Sulphite of Baryta.

I.) *mono.* Permanent. Scarcely at all soluble in water. Soluble in sulphurous acid. (Fourcroy.) Almost insoluble in water. Very sparingly soluble in sulphurous acid. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 75.)
BaO, SO_2

Sulphite of BenzoylAmmonium. Very soluble in water. (Bertagnini.)

Sulphite of BenzoylPotassium. Very easily soluble in pure water; less soluble in water which contains an alkaline sulphite, and nearly insoluble in a cold concentrated solution of an alkaline sulphite. The aqueous solution is decomposed on ebullition. Sparingly soluble in cold, readily soluble in boiling alcohol; decomposed by continued ebullition. (Bertagnini.)

Sulphite of BenzoylSodium. Readily soluble in water; the solution undergoing decomposition when boiled. Insoluble in an aqueous solution of bisulphite of soda. Tolerably soluble in hydrated alcohol. Insoluble in cold, sparingly soluble in boiling, absolute alcohol.
$C_{14}H_5NaO_2, 2SO_2 + 3Aq$

Sulphite of Bismuth. Insoluble in water, or in sulphurous acid. (Fourcroy.)
BiO_3, SO_2

Sulphite of BromoNaphtoyl. *Vid.* SulphoBromoNaphthalic Acid.

Sulphite of BromoSalicoylPotassium. Readily soluble in water. Decomposed by acids.
$C_{14}H_4BrKO_4, 2SO_2$

Sulphite of BromoSalicoylSodium. Readily soluble in water. Decomposed by acids.

Sulphite of Butoylammonium.
$C_8H_7(NH_4)O_2, S_2O_4$

Sulphite of ButoylSodium.
$C_8H_7NaO_2, S_2O_4$

Sulphite of Cadmium. Difficultly soluble in water. Insoluble in alcohol. Soluble, with combination, in ammonia-water. (Muspratt.) Soluble in sulphurous acid. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **8.** 352.)
$CdO, SO_2 + 2Aq$

Sulphite of Cadmium & of CadmiumAmmonium. Decomposed by water. Soluble in ammonia-water. (Rammelsberg.)
$N\left\{\begin{matrix}H_3\\Cd\end{matrix}\right. \cdot O, SO_2; CdO, SO_2$

Sulphite of CapricylPotassium. Decomposed by warm water. Insoluble in saturated aqueous solutions of the bisulphites of potash and of soda. Very soluble in cold spirit. (Limpricht, *Ann. Ch. u. Pharm.*, **93.** 243.)
$C_{16}H_{15}KO_2, 2SO_2 + 3Aq$

Sulphite of CapricylSodium. Similar to the potassium compound. (Limpricht, *loc. cit.*)

Sulphite of Cerium.

I.) CeO, SO_2 Soluble in water, the solution undergoing decomposition, with precipitation of No. 2, on boiling. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 77.)

II.) *basic.* Insoluble in water. (Berthier, *loc. cit.*)

Sulphite of Chloride of Carbon. *Vid.* Sulphite of Chloride of ChloroMethyl.

Sulphite of Chloride of *bi*ChloroMethyl. Soluble in water, and alcohol, but the solutions are easily decomposed.
(*Chloride of biChlorMethyl Sulphurous Acid.*
Sulphite of proto Chloride of Carbon.
Carbonate of proto Chloride of Sulphur.)
$CClSO_2$ or $C_2S_2Cl_2O_4$ (of Kolbe)
$C_2HCl_3S_2O_4$ (of Gerhardt) $= \left.\begin{matrix}C_2HCl_2\\Cl\end{matrix}\right\}S_2O_4$

Sulphite of Chloride of *ter*ChloroMethyl. Insoluble in water or acids. Slowly decomposed by cold water, more rapidly by hot water. Easily soluble in bisulphide of carbon, in alcohol, and ether.
(*Chloride of ter ChloroMethylSulphurous Acid.*
Sulphite of PerChloride of Carbon.
OxyChloride of Sulphide of Carbon.
Carbonate of biChloride of Sulphur.
Chlorhyposulphite of ChloroCarbonic Oxide.)
$C_2Cl_4S_2O_4 = \left.\begin{matrix}C_2Cl_3\\Cl\end{matrix}\right\}S_2O_4$

Sulphite of ChloroBenzene. *Vid.* Chloride of SulphoPhenyl.

Sulphite of ChloroNaphthalin. Insoluble in cold, decomposed by boiling water. Soluble in ether, benzin, bisulphide of carbon, and oxychloride of phosphorus; likewise in alcohol, but not without alteration. (Kimberly.)
(*NaphthylSulphurous Chloride.*)
$C_{20}H_7Cl'', 2SO_2$

Sulphite of ChloroNaphtoyl. *Vid.* SulphoChloroNaphthalic Acid.

*Bi*Sulphite of *quinqui*Chloride of Phosphorus. Decomposed by water. (Kremers.)
$PCl_5, 2SO_2$

*Ter*Sulphite of *quinqui*Chloride of Phosphorus.
$PCl_5, 3SO_2$

Sulphite of ChloroSalicoylAmmonium.

Sulphite of ChloroSalicoylPotassium.
$C_{14}H_4ClKO_4, S_2O_4$

Sulphite *of protoxide* of Chromium. Insoluble in water.

Sulphite *of sesquioxide* of Chromium.

I.) *normal?* ("*basic.*") Insoluble in water, or alcohol. Soluble in cold aqueous solutions of the carbonates of potash, and soda, and in ammonia-water. (Berthier.)
$Cr_2O_3, 3SO_2$

II.) Soluble in water. Decomposed, with precipitation of No. I., by alcohol.
$2(Cr_2O_3, SO_2); HO, SO_2 + 15Aq$

Sulphite of CinnamoylAmmonium.

Sulphite of CinnamoylPotassium. Permanent. Soluble in cold, decomposed by boiling water. Almost insoluble in concentrated aqueous solutions of the alkaline sulphites. Very sparingly soluble in cold alcohol or spirit. Easily soluble in boiling alcohol. Insoluble in ether. (Bertagnini.)
$C_{18}H_7KO_2, 2SO_2$

Sulphite of CinnamoylSodium. Soluble in boiling alcohol. (Bertagnini.)

Sulphite of Cobalt.

I.) *mono.* Almost insoluble in water. Insoluble in alcohol. (Muspratt.)
$CoO, SO_2 + 5Aq$

II.) [?] "*basic.*" Partially soluble in water, becoming more and more basic by washing. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 79.)

Sulphite *of dinoxide* of Copper. Decomposes gradually in moist air. Scarcely at all soluble in water. Soluble in sulphurous and chlorhydric acids, and in ammonia-water. Sulphuric acid, even when dilute and cold, decomposes it instantly. (Ber-
$Cu_2O, SO_2 + 2Aq$

thier, *Ann. Ch. et Phys.*, (3.) **7.** 80.) Decomposed by boiling with water.

Sulphite *of protoxide* of Copper. The aqueous solution of this salt decomposes spontaneously on standing, especially if exposed to solar light, and very rapidly on heating. (Berthier, *loc. cit.*)

Sulphite *of dinoxide & of protoxide* of Copper.

I.) *Red salt.* Insoluble in water, in sulphurous or acetic acids, or in solutions of the oxysalts of copper. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **42.** 24.)
$Cu_2O, SO_2; CuO, SO_2 + 2 Aq$

II.) *Yellow salt.* Insoluble in water. Easily soluble in sulphurous and acetic acids. It is also dissolved, especially when recently prepared and still moist, in aqueous solutions of the oxysalts of copper. When boiled with pure water it is decomposed in an irregular manner, but when boiled with water which contains a little sulphurous acid it is rapidly converted into the red salt (No. I.). Soluble in ammonia-water, and in chlorhydric acid with decomposition. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **42.** 25.)
$Cu_2O, SO_2; CuO, SO_2 + 5 Aq$

Sulphite *of dinoxide & of protoxide* of Copper & of Potash. Insoluble in water, and in weak acids.
$2(Cu_2O, SO_2); CuO, SO_2; KO, SO_2 + 5 Aq$

Sulphite *of protoxide* of Copper & of Mercury. Soluble in water in all proportions, the solution undergoing decomposition when boiled. Decomposed by alcohol. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **42.** 40.)
$CuO, SO_2; HgO, SO_2$

Sulphite *of dinoxide* of Copper & of Potash.

I.) Decomposed by long-continued washing with water. (Chevreul.)
$Cu_2O, SO_2; 2(KO, SO_2)$

II.) Soon decomposes in the air.
$Cu_2O, SO_2; 8(KO, SO_2) + 16 Aq$

Sulphite *of protoxide* of Copper & of Potash. Insoluble in water.

Sulphite *of dinoxide* of Copper & of Soda. Soluble in water. When added to the aqueous solution, alcohol precipitates a sirupy layer of the salt. (Muspratt.)
$Cu_2O, SO_2; 5(NaO, SO_2) + 38 Aq$

Sulphite of Cumoyl("Cumyl")Ammonium. Soluble in boiling, less soluble in cold alcohol. (Bertagnini.)

Sulphite of CumoylPotassium. Soluble, without decomposition, in water containing a small quantity of a bisulphite; but insoluble in concentrated solutions of the alkaline bisulphites. (Bertagnini.)

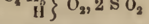
Sulphite of CumoylSodium. Insoluble in cold, decomposed by boiling water. (Trapp.) Soluble in hot, less soluble in cold, very dilute alcohol. Insoluble in ether. Soluble in a very dilute aqueous solution of bisulphite of soda, but the solution is very readily decomposed when boiled. Insoluble in concentrated solutions. (Bertagnini.)
$C_{20}H_{11}NaO_2, 2SO_2 + 4 Aq$

Sulphite of Didymium. Insoluble in water. Soluble in a cold aqueous solution of sulphurous acid, from which it is precipitated on the application of heat, redissolving on cooling. (Marignac, *Ann. Ch. et Phys.*, (3.) **38.** 167.)
$DiO, SO_2 + 2 Aq$

Sulphite of Dumasin & of Sodium. Readily soluble in water. Decomposed at once by boiling water. (Fittig.)
$C_{12}H_9NaO_2, 2SO_2 + 6 Aq$

Sulphite of Ethyl.

I.) *acid.* *Vid.* EthylSulphurous Acid.

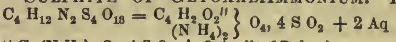

$\left.\begin{matrix}C_4H_5\\H\end{matrix}\right\} O_2, 2SO_2$

II.) *normal.* Very sparingly soluble, with decomposition, in water. Soluble in all proportions in alcohol, from which it is precipitated on the addition of water. Soluble in ether. (Ebelmen & Bouquet, *Ann. Ch. et Phys.*, (3.) **17.** 67.)
(*EthylSulphite of Ethyl.*)
C_4H_5O, SO_2

Sulphite of EthylAcetyl Sodium. Very soluble in water. (Fittig.)
$C_{10}H_9NaO_2, 2SO_2 + 3 Aq$

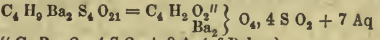
Sulphite of Glucina. Hydrate of glucina is readily soluble in cold sulphurous acid, and this solution does not become troubled when boiled. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** pp. 75–83.)
$Gl_2O_3, 3SO_2$

Sulphite of GlyoxalAmmonium. Easily soluble in water, especially if it be hot. Insoluble in alcohol. (Debus, *Ann. Ch. u. Pharm.*, **102.** 20.) The aqueous solution is partially decomposed by long-continued boiling.


$C_4H_{12}N_2S_4O_{18} = \left.\begin{matrix}C_4H_2O_2''\\(NH_4)_2\end{matrix}\right\} O_4, 4SO_2 + 2 Aq$

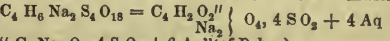
"$C_4(NH_4)_2O_4, 4SO_2 + 2 Aq$"(of Debus)

Sulphite of GlyoxalBarium. Very difficultly soluble in cold, tolerably easily soluble in boiling water. (Debus, *loc. cit.*)


$C_4H_9Ba_2S_4O_{21} = \left.\begin{matrix}C_4H_2O_2''\\Ba_2\end{matrix}\right\} O_4, 4SO_2 + 7 Aq$

"$C_4Ba_2O_4, 4SO_2 + 9 Aq$(of Debus)

Sulphite of GlyoxalSodium. Easily soluble in water. Soluble in dilute, but insoluble in absolute alcohol. (Delus, *loc. cit.*)


$C_4H_6Na_2S_4O_{18} = \left.\begin{matrix}C_4H_2O_2''\\Na_2\end{matrix}\right\} O_4, 4SO_2 + 4 Aq$

"$C_4Na_2O_4, 4SO_2 + 6 Aq$"(of Debus)

Sulphite of Gold & of Potash. Known only in aqueous solution. (Berzelius, *Lehrb.*)

Sulphite of Gold & of Soda. Soluble in water. Insoluble in alcohol.

Sulphite of Harmalin. Readily soluble in water.

Sulphite of Harmin. Readily soluble in water.

Sulphite of Iridium & of Potash. Sparingly soluble in water. Readily soluble in chlorhydric acid. More soluble in an aqueous solution of caustic potash than in water. (Claus.)
$IrO, 2SO_2; 3(KO, SO_2), \& + 5 Aq$

Sulphite *of protoxide* of Iron. Exceedingly easily decomposed when exposed to the air. Sparingly soluble in water. Easily soluble in sulphurous acid. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **8.** 351.) Insoluble in alcohol. (Kœne.)
$FeO, SO_2 + 3 Aq$

Sulphite *of sesquioxide* of Iron.

I.) Decomposes in the air to sulphate. Very sparingly soluble in water. Soluble in dilute acids. After having once become dry, it is no longer soluble in water, and is permanent in the air. (Kœne.) Sparingly soluble in cold, easily soluble, with decomposition, in warm sulphurous acid. (Kœne.)
$Fe_2O_3, SO_2 + 6 \text{ or } 7 Aq$

II.) *basic.* Soluble compounds as basic as $Fe_2\,O_3,\,2\,S\,O_2$ may be obtained. (Ordway, *Am. J. Sci.*, 1858, (2.) **26**. 202.) Insoluble in alcohol. (Berzelius.)

Sulphite of Iron & of Potash.

I.) Ppt.
$Fe_2\,O_3,\,S\,O_2\,;\;K\,O,\,2\,S\,O_2$

II.) Ppt.
$Fe_2\,O_3,\,S\,O_2\,;\;2\,(K\,O,\,S\,O_2)+5\,Aq$

Sulphite of Lead. Insoluble in water. $Pb\,O,\,S\,O_2$ Decomposed by chlorhydric, sulphuric, and nitric acids. Sparingly soluble in sulphurous acid.

Far more insoluble than the sulphate; indeed it is one of the most insoluble salts known. (Gregory, *Rep. Br. Assoc.*, 1850, p. 55.)

Sulphite of Lime. Slowly effloresces. $Ca\,O,\,S\,O_2+2\,Aq$ Soluble in 800 pts. of cold water; 100 pts. of water dissolving 0.125 pt. of it. (Berzelius.) Readily soluble in sulphurous acid, forming bisulphite of lime, which is slowly efflorescent, and much more soluble in water. (Schubarth, *Tech.*) Scarcely more soluble in water than the sulphate; it dissolves in tolerably large quantity in sulphurous acid, but on boiling this solution it separates out again for the most part. (Berthier, *Ann. Ch. et Phys.*, (3.) **7**. 75.)

Sulphite of Lithia. Soluble in water. $Li\,O,\,S\,O_2+6\,Aq$ Insoluble in alcohol. Soluble in sulphurous acid.

Sulphite of Magnesia.

I.) *mono.* Decomposes in the air. Difficultly $Mg\,O,\,S\,O_2+3\,Aq\;\&\;6\,Aq$ soluble in water. (Muspratt.) Soluble in sulphurous acid. Soluble in water, from which it is precipitated by spirit of wine. Decomposed by vinegar and other acids. (Bergman, *Essays*, **1**. 442.)

II.) *acid.* Efflorescent. Soluble in 20 pts. of $Mg\,O,\,2\,S\,O_2$ water at 16°, and in far less boiling water. (Fourcroy & Vauquelin.)

Sulphite of Manganese. Permanent. $Mn\,O,\,S\,O_2+2\,Aq$ Sparingly soluble in water. (Berthier, *Ann. Ch. et Phys.*, (3.) **7**. 78.) Although difficultly soluble in water, it crystallizes out only after the lapse of some time, resembling in this respect ordinary phosphate of ammonia and magnesia. (Heeren, *Pogg. Ann.*, 1826, **7**. 63 [note].) Insoluble in water, or alcohol. (John.) Or in ether. (Muspratt.) Easily soluble in sulphurous acid. (Berthier, *loc. cit.*)

Sulphite of Mercury.

I.) *bi.* Tolerably easily soluble in water. $Hg\,O,\,2\,S\,O_2+Aq$ (Wicke, *Ann. Ch. u. Pharm.*, **95**. 176.)

II.) *basic.* Decomposed when boiled with wa- $Hg\,O,\,S\,O_2+2\,Hg\,O,\,S\,O_2$ *(in varying proportions)* ter. Soluble in great part in aqueous solutions of the alkaline sulphites, with partial decomposition; also soluble in solutions of the alkaline cyanides, and in cold chlorhydric acid. (Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **36**. 84.)

III.) Consists, according to Péan de St. Gilles $2\,Hg_2\,O,\,3\,S\,O_2\,;\;3\,Hg\,O,\,4\,S\,O_2$ (of Rammelsberg) (*loc. cit.*, p. 82), of a mixture of $Hg_2\,O,\,S\,O_3\;\&\;Hg\,O,\,S\,O_2$.

Sulphite of Mercury & of Potash. $Hg\,O,\,S\,O_2\,;\;K\,O,\,S\,O_2+Aq$ Sparingly soluble in cold, decomposed by boiling water. (Péan de St. Gilles, *loc. cit.*, pp. 90, 93.)

Sulphite of Mercury & of Soda.

I.) More soluble in water than the correspond- $Hg\,O,\,S\,O_2\,;\;Na\,O,\,S\,O_2+Aq$ ing potash salt. Decomposed by boiling water. (*Idem, loc. cit.*)

II.) Much more soluble in water than the pre- $2\,(Hg\,O,\,S\,O_2)\,;\;Na\,O,\,S\,O_2+Aq$ ceding salt (No. I.). Decomposed by boiling water. (*Idem, loc. cit.*, pp. 90, 94.)

Sulphite of MesitylAmmonium, &c. *Vid.* Sulphite of AcetoneAmmonium, &c.

Sulphite of Nickel.

I.) *mono.* Insoluble in water. Easily soluble $Ni\,O,\,S\,O_2+4\,Aq\;\&\;6\,Aq$ in sulphurous acid, and, with decomposition, in chlorhydric acid. (Muspratt.)

II.) [?] "*basic.*" Partially soluble in water, becoming more and more basic when washed with water. (Berthier, *Ann. Ch. et Phys.*, (3) **7**. 79.)

Sulphite of Nitric Oxide & Potash. $N\,O_2,\,K\,O,\,S\,O_2$ Easily soluble in water, but the solution decomposes on standing. Insoluble in alcohol. (Pelouze.)

Sulphite of Nitric Oxide & Soda. $N\,O_2,\,Na\,O,\,S\,O_2$ Resembles the corresponding potash compound, but is more soluble in water. (Pelouze.)

Sulphite of NitroBenzoicyl("Benzoyl") Ammonium. $C_{14}\,H_{11}\,N_2\,S_2\,O_{18}=\left.\begin{matrix}C_{14}\,H_4\,(N\,O_4)\\ N\,H_4\end{matrix}\right\}O_2,\,2\,S\,O_2+3\,Aq$ Readily soluble in cold, decomposed by boiling water. Very sparingly soluble in cold, easily soluble in boiling alcohol. Very abundantly soluble in a hot, less soluble in cold aqueous solution of bisulphite of ammonia. (Bertagnini.)

Sulphite of NitroBenzoicylSodium. $\left.\begin{matrix}C_{14}\,H_4\,(N\,O_4)\\ Na\end{matrix}\right\}O_2,\,2\,S\,O_2+12\,Aq$ Efflorescent. Sparingly soluble in cold, readily soluble in boiling water. Soluble in an aqueous solution of sulphite of soda. Insoluble in cold alcohol. (Bertagnini.)

Sulphite of NitroHarmalin. Very sparingly soluble in cold water, and even more difficultly soluble in water acidulated with sulphurous acid.

Sulphite of NitroSalicoyl("Salicyl") Ammonium.

Sulphite of NitroSalicoylPotassium. More soluble than the corresponding sodium compound.

Sulphite of NitroSalicoylSodium. Soluble in water. Insoluble in alcohol. (Bertagnini.)

Sulphite of ŒnanthoylAmmonium. $C_{14}\,H_{13}\,(N\,H_4)\,O_2,\,2\,S\,O_2$ Sparingly soluble in water. Slowly decomposed by cold water, but quickly by hot water and by acids. Sparingly soluble in cold, somewhat more soluble in hot alcohol. (Bertagnini; Tilley.)

Sulphite of ŒnanthoylPotassium. Soluble in a warm aqueous solution of bisulphite of potash, and in alcohol. (Bertagnini.)

Sulphite of ŒnanthoylSodium. $C_{14}\,H_{13}\,Na\,O_2,\,2\,S\,O_2+4\,Aq$ Readily soluble in cold, and very soluble, without alteration, in warm water. Almost insoluble in cold, readily soluble in warm alcohol. (Bertagnini.) Soluble in an aqueous solution of bisulphite of soda. (Bouis.)

Sulphite of Osmium & of Potash. Sparingly soluble in water. (Claus.)
$\mathrm{OsO, 2SO_2; 3(KO, SO_2) + 5\,Aq}$

Sulphite of Picolin. Soluble in all proportions in water. (Unverdorben.)

***Bi*Sulphite of Platin(*ous*)*bi*amin.** Easily soluble in water, from which it is precipitated on the addition of alcohol. Not precipitated by caustic alkalies or soluble metallic sulphides. (Liebig, *Ann. Ch. u. Pharm.*, **23.** 23; Bœckmann, *Ibid.*, **42.** 316 (*note*).)
$\mathrm{N_2}\left\}\mathrm{H_6} \right. \cdot \mathrm{PtO, 2SO_2}$

Sulphite of Platin(*ous*)*bi*amin & of Platin(*ous*)ammonium.

I.) Scarcely at all soluble in cold water. Soluble in 190 pts. of boiling water. (Peyrone, *Ann. Ch. u. Pharm.*, **61.** 181.)
$\mathrm{N}\left\{\begin{matrix}\mathrm{H_3}\\ \mathrm{Pt}\end{matrix}\right. \cdot \mathrm{O, SO_2}; \mathrm{N_2}\left\{\mathrm{H_6}\right. \cdot \mathrm{PtO, SO_2 + 2\,Aq}$

II.) Insoluble in cold, very sparingly soluble in boiling water. Insoluble in alcohol. (Peyrone, *Ann. Ch. u. Pharm.*, **61.** 178.)
$2\left(\mathrm{N}\left\{\begin{matrix}\mathrm{H_3}\\ \mathrm{Pt}\end{matrix}\right. \cdot \mathrm{O, SO_2}\right); \mathrm{N_2}\left\}\begin{matrix}\mathrm{H_6}\\ \mathrm{Pt}\end{matrix}\right. \cdot \mathrm{O, HO, 2SO_2}$

Sulphite *of protoxide* of Platinum. Known only in aqueous solution, and in combination. (Berzelius, *Lehrb.*)

Sulphite *of binoxide* of Platinum. Easily soluble in water, and alcohol. It is not decomposed either by chlorhydric or sulphuric acid. (Dœbereiner.) With alkaline sulphites it forms double salts.
$\mathrm{PtO_2, 2SO_2}$

Sulphite *of protoxide* of Platinum & of Potassium. Soluble in an aqueous solution of sulphite of potash.
$\mathrm{PtO, 2SO_2; 3(KO, SO_2) + 2\tfrac{1}{2}\,Aq}$

Sulphite of Platinum & of Soda.

I.) Tolerably easily soluble in water. (Litton & Schnedermann.) Insoluble in a solution of chloride of sodium.
$\mathrm{PtO, SO_2; NaO, SO_2 + Aq}$

II.) Slightly soluble in cold, somewhat more soluble in hot water. Soluble in an aqueous solution of cyanide of potassium, and in boiling solutions of the sulphides of ammonium and of potassium. Insoluble in alcohol, or in solutions of the chlorides of sodium, ammonium, or barium, or of nitrate of silver. Other salts do not interfere with its solubility in water. Soluble, with decomposition, in acids. Not decomposed by boiling aqueous solutions of caustic potash and soda. (Litton & Schnedermann.)
$\mathrm{PtO, SO_2; 3(NaO, SO_2)}$

Sulphite of Potash.

I.) *mono.* Deliquescent. Easily soluble in water. Very sparingly soluble in alcohol. Alcohol precipitates it from the aqueous solution. (Muspratt.) Soluble in 1 pt. of cold, and in much less hot water. (Fourcroy.) Much less soluble than the sulphites of soda or of ammonia. (Péan de St Gilles, *Ann. Ch. et Phys.*, (3.) **36.** 83.) Insoluble in commercial acetate of ethyl. (Casaseca, *C. R.*, 1850, **30.** 821.)
$\mathrm{KO, SO_2 + 2\,Aq}$

II.) *bi.*

a = anhydrous. Permanent. Slowly soluble in water. Very sparingly soluble in alcohol. Insoluble in ether. (Muspratt.)
$\mathrm{KO, 2SO_2}$

b = hydrated. Insoluble in absolute alcohol.
$\mathrm{KO, HO, 2SO_2}$

Sulphite of Potash & of Ruthenium. Sparingly soluble in water. (Claus.)
$\mathrm{KO, SO_2; RuO, SO_2}$

Sulphite of Potash & of Silver.

Sulphite of PropionAmmonium. Very soluble in water. (Limpricht, *Ann. Ch. u. Pharm.*, **94.** 328.)

Sulphite of PropionPotassium. Insoluble, or very sparingly soluble, in an aqueous solution of bisulphite of potash. (Idem.)
$\mathrm{C_{10}H_9KO_2, 2SO_2 + 3\,Aq}$

Sulphite of PropionSodium. Insoluble, or very sparingly soluble, in an aqueous solution of bisulphite of soda. (Idem.)
$\mathrm{C_{10}H_9NaO_2, 2SO_2 + 3\,Aq}$

Sulphite of Rutoyl("Rutyl")Ammonium. Soluble in water, but the solution is easily decomposed. Soluble in warm spirit. More soluble in cold alcohol than the sulphite of œnanthoylammonium. (Bertagnini.) Insoluble in water. Readily soluble in boiling alcohol. (Wagner.)
$\mathrm{C_{20}H_{19}(NH_4)O_2, 2SO_2 + 4\,Aq}$

Sulphite of RutoylPotassium. Tolerably soluble in boiling, less soluble in cold alcohol. (Bertagnini.)

Sulphite of RutoylSodium. Soluble in boiling alcohol.

Sulphite of Salicoyl("Salicyl")Ammonium. Soluble in warm, less soluble in cold water. (Bertagnini.)

Sulphite of SalicoylPotassium. Readily soluble in cold, decomposed by boiling water. Easily soluble in warm, less soluble in cold alcohol. Decomposed by acids, and by alkaline solutions. (Bertagnini.)
$\mathrm{C_{14}H_5KO_4, 2SO_2 + 2\,Aq}$

Sulphite of SalicoylSodium. Readily soluble in water. Soluble, with partial decomposition, in boiling alcohol. Soluble in warm hydride of salicyl. (Bertagnini.)
$\mathrm{C_{14}H_5NaO_4, 2SO_2 + Aq}$

Sulphite of Silver. Permanent. Very slightly soluble in water. (Muspratt.) Insoluble in water, and almost insoluble in sulphurous acid. It is not decomposed by acetic acid, but the strong acids expel sulphurous acid from it. Easily soluble in ammonia-water. Decomposed when boiled with water, or heated to 100° in the air. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 82.) Soluble in aqueous solutions of the alkaline sulphites, forming double salts which easily decompose.
$\mathrm{AgO, SO_2}$

Readily soluble, with decomposition, in aqueous solutions of the soluble hyposulphites. (Herschel, *Edin. Phil. Journ.*, 1819, **1.** 397.)

Sulphite of Silver & of Soda.

Sulphite of Soda.

I.) *mono.* Efflorescent. Soluble in 4 pts. of water at 15°, with reduction of temperature (Dumas), and in less than 1 pt. of boiling water. (Fourcroy.) Its maximum solubility is at 33°; it being less soluble at higher temperatures. (Mitscherlich.)
$\mathrm{NaO, SO_2 + 8\,Aq}$

Soluble in about 7.07 pts. of water at 0°
" 3.49 " 20°
" 2.02 " 40°
(Kremers, *Pogg. Ann.*, **99.** 50.)

Much more soluble than sulphite of potash.

(Péan de St. Gilles, *Ann. Ch. et Phys.*, (3.) **36.** 83.) Insoluble in commercial acetate of ethyl. (Casaseca, *C. R.*, 1850, **30.** 821.) Insoluble in alcohol.

II.) *bi.* $NaO, 2SO_2 + 10Aq$ Tolerably easily soluble in water. Less soluble in water than bicarbonate of soda. Insoluble in weak alcohol.

Sulphite of Strontia. SrO, SO_2 Slowly decomposes when exposed to the air. Scarcely at all soluble in water. Soluble in sulphurous acid. (Muspratt.) Almost insoluble in water. Very sparingly soluble in sulphurous acid. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 75.)

Sulphite of Sulphide of Ethyl. (*Sulphite of SulphEthyl. HypoSulphite of Ethylene.*) C_4H_5S, SO_2 Insoluble in water. Easily soluble in alcohol, and ether.

Sulphite of TellurMethyl.

Sulphite *of protoxide* of Tin.

I.) Soluble in water. [Y.]

II.) *basic.* Ppt. Decomposed by boiling with water. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 81.)

Sulphite of Toluidin.

Sulphite *of protoxide* of Uranium. $2UrO, SO_2 + 2Aq$ Insoluble in water. Readily soluble in acids. Easily soluble in sulphurous acid, but is reprecipitated as the solution is evaporated. (Rammelsberg.) The sulphurous acid solution rapidly oxidizes when exposed to the air. (A. Girard, *C. R.*, **34.** 22.)

Sulphite *of sesquioxide* of Uranium.

I) *normal.* $Ur_2O_3, SO_2 + 3Aq$ or $4Aq$ Permanent. Insoluble in water. (Muspratt.) Soluble both in aqueous and alcoholic solutions of sulphurous acid, from which solutions it is precipitated on boiling. (A. Girard, *C. R.*, 1852, **34.** 23.)

II.) *basic, granular.* Precipitated on boiling a solution of carbonate of ammonia and of uranium in sulphurous acid, or on boiling a mixture of sulphite of ammonia and a salt of uranium, but is not precipitated in the cold. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 76; compare Girard, *loc. cit.*)

Sulphite of Valeroyl(" Valeryl ")Ammonium. $C_{10}H_9(NH_4)O_2, 2SO_2$

Sulphite of ValeroylSodium. $C_{10}H_9NaO_2, 2SO_2 + 3Aq$ Sparingly soluble in cold water, more readily soluble in water at 70° @ 80°, but is decomposed at higher temperatures. Almost insoluble in anhydrous alcohol, and in ether. (Parkinson.)

Sulphite of Yttria. YO, SO_2 Insoluble in water. Sparingly soluble in sulphurous acid. (Berlin.) Hydrate, or carbonate, of yttria is soluble in sulphurous acid, but if this solution is boiled the yttria is completely precipitated as a subsulphite, which is entirely insoluble in water, but soluble in sulphurous acid. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 75.)

Sulphite of Zinc. $ZnO, SO_2 + 2Aq$ Sparingly soluble in water. Insoluble in alcohol. (Fourcroy & Vauquelin.) Sparingly soluble in water. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **8.** 350.) Easily soluble in sulphurous acid. (Berzelius, *Lehrb.*) Oxide of zinc is soluble in sulphurous acid, and if this solution is boiled it deposits a "sub"sulphite of zinc, which appears to decompose, and become less and less soluble when the ebullition is long continued. But solutions of the salts of zinc are not precipitated on the addition of sulphite of ammonia, even on boiling. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 81.)

Sulphite of Zirconia.

I.) *mono.* $Zr_2O_3, 3SO_2$ Insoluble in water. Slightly soluble in sulphurous acid, from which it is reprecipitated when the solution is boiled. [Compare Oxide of Zirconium (hydrated).] Soluble in an aqueous solution of sulphite of ammonia, from which hydrate of zirconia is precipitated on boiling. (Berzelius, *Lehrb.*)

SulphoAmylolic Acid. *Vid.* AmylSulphurous Acid.

SulphoBenzamic Acid. $C_{14}H_7NS_2O_8 = N\left\{\begin{matrix}C_{14}H_4O_2 . S_2O_4'' \\ H_2\end{matrix}\right. .O, HO$ Scarcely at all soluble in cold, more soluble in boiling water; more readily soluble in alcohol, and ether.

SulphoBenzamate of Ammonia. Soluble in water.

SulphoBenzamate of Baryta. $C_{14}H_6BaNS_2O_8 + 4Aq$ Soluble in water.

SulphoBenzamate of Ethyl. $C_{14}H_6(C_4H_5)NS_2O_8$ Easily soluble in hot alcohol, and ether; less soluble in boiling water.

SulphoBenzamate of Silver. $C_{14}H_6AgNS_2O_8 + 2Aq$ Tolerably easily soluble in hot water.

"SulphoBenzamid." *Vid.* SulphoBenzoylamid.

SulphoBenzamid. (*SulphoBenzoylamide.*) $C_{14}H_8N_2S_2O_8 = N_2\left\{\begin{matrix}C_{14}H_4O_2(S_2O_4)'' \\ H_4\end{matrix}\right. \& + 2Aq$ Nearly insoluble in cold, easily soluble in hot water. Sparingly soluble in cold alcohol; readily soluble in hot alcohol, either hydrated or anhydrous. (Limpricht & v. Uslar, *Ann. Ch. u. Pharm.*, **102.** 253.)

SulphoBenzAnilid. *Vid. di*PhenylSulphoBenzoyl*bi*amid.

SulphoBenzene. *Vid.* SulphoBenzid.

SulphoBenzid. (*SulphoBenzole. SulphoBenzen. Phenylthionoxyde. Phenylide of SulphoPhenyl.*) $C_{24}H_{10}S_2O_4 = \left.\begin{matrix}C_{12}H_5S_2O_4 \\ C_{12}H_5\end{matrix}\right\}$ Very sparingly soluble in water. Soluble in alcohol, and ether. Soluble in somewhat concentrated acids, from which it is precipitated on the addition of water. Insoluble in aqueous solutions of the alkalies. (Mitscherlich.)

Scarcely at all soluble in water. Sparingly soluble in cold, more readily soluble in hot spirit. Soluble, without decomposition, in warm dilute nitric acid; decomposed by concentrated nitric acid. Insoluble in hot dilute nitric acid. Soluble in warm dilute sulphuric acid, separating out again unchanged as the solution cools. Soluble, with decomposition, in warm concentrated sulphuric acid. (Gericke, *Ann. Ch. u. Pharm.*, **100.** 207.)

SulphoBenzidic Acid. *Vid.* PhenylSulphurous Acid.

SulphoBenzoic Acid. $C_{14}H_6S_2O_{10} = C_{14}H_4O_2'', 2HO, 2SO_3$ Deliquesces in moist air. Soluble in water. (Mitscherlich.)

SulphoBenzoate of Baryta.

I.) *normal.* $C_{14}H_4Ba_2S_2O_{10}$ Very soluble in water. (Mitscherlich; Fehling.)

II.) *acid.* Permanent. Soluble in 20 pts. of water at 20°; more soluble in warm water. (Mitscherlich.)
$C_{14} H_5 Ba S_2 O_{10} + 3 Aq$

SulphoBenzoate of Cobalt.

SulphoBenzoate *of protoxide* **of Copper.**

SulphoBenzoate of Ethyl.

I.) *normal.* Soluble in all proportions in water; the solution undergoing decomposition when boiled. Soluble in alcohol. (Limpricht & v. Uslar, *Ann. Ch. u. Pharm.*, **102.** 252.)
$C_{14} H_4 (C_4 H_5)_2 S_2 O_{10}$

II.) *mono. Vid.* EthylSulphoBenzoic Acid.
$C_{14} H_5 (C_4 H_5) S_2 O_{10}$

SulphoBenzoate *of protoxide* **of Iron.**

SulphoBenzoate of Lead. Readily soluble in hot, sparingly soluble in cold water. (Fehling.)
$C_{14} H_4 Pb_2 S_2 O_{10} + 4 Aq$

SulphoBenzoate of Lime.

SulphoBenzoate of Magnesia.

SulphoBenzoate of Nickel.

SulphoBenzoate of Potash.

I.) *normal.* Deliquesces in moist air.

II.) *acid.* Efflorescent.

SulphoBenzoate of Silver. Readily soluble in water.
$C_{14} H_4 Ag_2 S_2 O_{10} + 2 Aq$

SulphoBenzoate of Soda.

SulphoBenzoate of Zinc.

SulphoBenzoenic Acid. *Vid.* ToluenylSulphurous Acid.

SulphoBenzol. *Vid.* SulphoBenzid; and also Sulphide of Benzol.

SulphoBenzolic Acid. *Vid.* PhenylSulphurous Acid.

***Bi*SulphoBenzolic Acid.**
(*Bi ThioBenzolic Acid.*)
$C_{12} H_6 S_4 O_{12}$

***Bi*SulphoBenzolate of Baryta.** Very readily soluble in water, from which it is precipitated on the addition of alcohol. (Buckton & Hofmann, *J. Ch. Soc.*, **9.** 256.)
$C_{12} H_4 Ba_2 S_4 O_{12}$

SulphoBenzoVinic Acid. *Vid.* EthylSulphoBenzoic Acid.

SulphoBismuthate of *X*. *Vid.* Sulphide of Bismuth and of *X*.

" **SulphoBenzoylamid.** *Vid.* SulphoBenzamid.

SulphoBenzoylamid. Soluble in boiling water.
(*SulphoBenzamid.*)
$C_{14} H_7 N S_2 = N \left\{ \begin{matrix} C_{14} H_5 S_2 \\ H_2 \end{matrix} \right.$

SulphoBromoBenzolicAcid. *Vid.* BromoPhenylSulphurous Acid.

SulphoBromoNaphthalic Acid. *Vid.* BromoSulphoNaphthalic Acid.

SulphoBromoSalicylous Acid. *Vid.* Sulphide of BromoSalicene.

SulphoButylic Acid. *Vid.* ButylSulphuric Acid.

SulphoButyric Acid.
$C_8 H_8 S_2 O_{10} = C_8 H_6 S_2 O_8, 2 HO$

SulphoButyrate of Baryta. Very readily soluble in water; somewhat less soluble in alcohol. (Buckton & Hofmann, *J. Ch. Soc.*, **9.** 253.)
$C_8 H_6 Ba_2 S_2 O_{10}$

SulphoCacodylic Acid. Not isolated.
$C_4 H_7 As S_4$

SulphoCacodylate of Antimony. May be washed with alcohol.
$C_{12} H_{18} As_3 Sb S_{12}$

SulphoCacodylate of Bismuth. Permanent. Insoluble in water. Scarcely at all soluble in alcohol, and ether.
$C_{12} H_{18} As_8 Bi S_{12}$

SulphoCacodylate of Cacodyl. *Vid. Bi*-Sulphide of Cacodyl.

SulphoCacodylate of Copper. Insoluble in water, alcohol, ether, or dilute acids.
$C_4 H_6 Cu As S_4$

SulphoCacodylate of Gold. Insoluble in water, alcohol, ether, or chlorhydric acid. (Bunsen.)
$C_4 H_6 Au As S_4$

SulphoCacodylate of Lead. Permanent. Insoluble in water, and nearly insoluble in alcohol.
$C_4 H_6 Pb As S_4$

SulphoCamphic Acid. *Vid.* ThymylSulphurous Acid.

SulphoCamphoric Acid. Extremely soluble in water; the anhydrous acid dissolving even more rapidly than the hydrated. Very soluble in alcohol, either ordinary or absolute. Soluble in ether. Insoluble in cold, very sparingly soluble in warm oil of turpentine. Insoluble in bisulphide of carbon, either hot or cold. Slowly soluble in cold, readily soluble, without decomposition, in boiling nitric acid. Soluble in cold nitrous-nitric acid. Sparingly soluble in cold, somewhat more soluble in hot chlorhydric acid. Sparingly soluble in cold concentrated sulphuric acid, but dissolves readily when this is gently warmed, decomposing when strongly heated. (Walter, *Ann. Ch. et Phys.*, (3.) **9.** 186.) All of the salts of sulphocamphoric acid are soluble.
$C_{18} H_{16} S_2 O_{12} = C_{18} H_{14} O_4, 2 H O, 2 S O_3 \& + 4 Aq$

SulphoCamphorate of Ammonia. Very soluble in water. Sparingly soluble in alcohol. (Walter, *loc. cit.*, p. 191.)
$C_{18} H_{14} (N H_4)_2 S_2 O_{12} + 2 Aq$

SulphoCamphorate of Baryta. Very soluble in water. Sparingly soluble in alcohol. (Walter, *loc. cit.*, p. 195.)
$C_{18} H_{14} Ba_2 S_2 O_{12}$

SulphoCamphorate of Baryta & of Copper. Soluble in cold water, the solution undergoing decomposition when heated.
$C_{18} H_{14} Ba Cu S_2 O_{12}$

SulphoCamphorate of Copper. Soluble in water. Insoluble in alcohol. (Walter, *loc. cit.*, p. 198.)
$C_{18} H_{14} Cu_2 S_2 O_{12} + 4 Aq$

SulphoCamphorate of Lead. Soluble in water. Insoluble in alcohol. (Walter, *loc. cit.*, p. 197.)
$C_{18} H_{14} Pb_2 S_2 O_{12}$

SulphoCamphorate of Lime. Soluble in water; less soluble in alcohol.
$C_{18} H_{14} Ca_2 S_2 O_{12}$

SulphoCamphorate of Potash. Very soluble in water. Sparingly soluble in ordinary alcohol; and still less soluble in absolute alcohol. Very sparingly soluble in ether. (Walter, *loc. cit.*, p. 190.)
$C_{18} H_{14} K_2 S_2 O_{12}$

SulphoCamphorate of Silver. Soluble in water, though less so than any of the other sulphocamphorates. Sparingly soluble in cold, and a little more soluble in warm alcohol. (Walter, *loc. cit.*, p. 198.)
$C_{18} H_{14} Ag_2 S_2 O_{12}$

SulphoCaprylic Acid. *Vid.* CaprylSulphuric Acid.

SulphoCarbamic Acid. Known only in aqueous solutions; in which it quickly decomposes. (Zeise.)

(Sulphide of Hydrogen & of SulphoCarbammonium. HydroThioSulphoCyanic Acid. HydroThioSulphoPrussic Acid.

$C_2 H_3 N S_4 = N \left\{ \begin{matrix} C_2 S_2'' \\ H_2 \end{matrix} \right. . S, H S$

Its salts were called *sulphocyanhydrates* by Berzelius.

SulphoCarbamate of Ammonia. $C_2 H_2 (N H_4) N S_4$ Deliquescent. Somewhat abundantly soluble in water. Very slowly soluble in cold, more quickly in warm alcohol; still more slowly soluble in ether, and not at all soluble in naphtha. (Zeise.)

"**SulphoCarbamate of Amyl.**" *Vid.* Xanthamylamid.

SulphoCarbamate of Barium. Soluble in water, and alcohol.

SulphoCarbamate of Calcium. Soluble in alcohol, and water.

SulphoCarbamate of Copper. Insoluble in cold water, and in alcohol. Slowly decomposed by boiling water.

"**SulphoCarbamate of Ethyl.**" *Vid.* Hydrate of SulphoCarbonylEthylammonium.

SulphoCarbamate of Iron. Ppt. Soon decomposed in contact with water.

SulphoCarbamate of Lead. $C_2 H_2 Pb N S_4$ Ppt., which soon decomposes. While recently precipitated, it is soluble in a solution of nitrate of lead.

Soluble in water. (Laurent, *Method.*, p. 250.)

SulphoCarbamate of Mercury. Ppt., soon decomposing.

SulphoCarbamate of Potassium. $C_2 H_2 K N S_4$ Soluble in water, and in alcohol. When in aqueous solution the salt is decomposed at a temperature below the boiling point. In the alcoholic solution decomposition occurs after standing for several days. (Zeise, *Schw.*, **41.** 192.)

SulphoCarbamate of Silver. Ppt. Soluble in water. (Laurent, *Method.*, p. 250.)

SulphoCarbamate of Zinc. Ppt.

SulphoCarbanilid. *Vid. di*PhenylSulphoCarbamid.

SulphoCarboMethylic Acid. *Vid.* OxySulphoCarbonate of Methyl.

SulphoCarboMethylic Ether. *Vid.* OxySulphoCarbonate of Methyl.

SulphoCarboNaphthalid. *Vid. di*NaphthylSulphoCarbamid.

"***Di*SulphoCarbonic Acid.**" *Vid.* OxySulphoCarbonic Acid.

SulphoCarbonic Acid. Not sensibly soluble in water. Miscible in all proportions with alcohol, ether, liquid carbonic acid, caoutchin, and many other organic liquids. Miscible with oil of turpentine (Lampadius), and the oils generally.

(BiSulphide of Carbon. Sulphide of SulphoCarbonyl.)

$C_2 S_2'', S_2 = 2 C S_2$

The vapors of bisulphide of carbon are best absorbed by an alcoholic solution of potash. They are scarcely at all acted upon by an aqueous solution of caustic potash, and are only very slowly absorbed by solutions of sulphate of copper, or acetate of lead, by concentrated sulphuric acid, or a chlorhydric acid solution of dichloride of copper. Slowly absorbed, with combination, by bromine. (Berthelot, *Ann. Ch. et Phys.*, (3.) **51.** 74.)

The compounds of sulphocarbonic acid (trisulphocarbonates, or sulphocarbonylsulphates) of the formula $\left. \begin{matrix} MS \\ MS \end{matrix} \right\} C_2 S_4$, with the alkalies, and those of some of the earths are soluble in water, the others being insoluble, and the solutions, when concentrated, are tolerably permanent in the air, but when dilute they are rapidly decomposed. The salts not soluble in water are soluble in alkaline solutions.

SulphoCarbonate of Ammonium. $N H_4 S, C S_2$ Deliquescent. Readily soluble, with decomposition, in water. Sparingly soluble in alcohol. Almost insoluble in ether. (Zeise.)

SulphoCarbonate of Amyl.

(TerSulpho Carbonate of Amyl.)

"***Mono*SulphoCarbonate of Amyl.**" *Vid.* AmylSulphoCarbonate of Amyl.

***Di*SulphoCarbonate of Amyl.** *Vid.* OxySulphoCarbonate of Amyl.

SulphoCarbonate of Barium. $Ba S, C S_2$ Difficultly soluble in water. (Berzelius.)

SulphoCarbonate of Bismuth. $Bi S_3, 3 C S_2$ Soluble in an aqueous solution of sulphocarbonate of calcium.

SulphoCarbonate of BromoMethyl. Insoluble in water, or alcohol. Only sparingly soluble in ether. (Kolbe's *Lehrb.*, **1.** 271.)

$C_6 H_4 Br_2 S_6 = \left. \begin{matrix} (C_2 H_2 Br)S \\ (C_2 H_2 Br)S \end{matrix} \right\} C_2 S_4$

SulphoCarbonate of Cadmium. $Cd S, C S_2$ Sparingly soluble in water. (Berzelius.)

SulphoCarbonate of Calcium. $Ca S, C S_2$ Hygroscopic. Readily soluble in alcohol, and in water, the solution undergoing decomposition when boiled. (Berzelius.)

SulphoCarbonate of Cerium. $Ce S, C S_2$ Appears to be soluble in water. (Berzelius, *Lehrb.*)

SulphoCarbonate of Chromium. $Cr_2 S_3, 3 C S_2$ Insoluble in water. (Berzelius.)

SulphoCarbonate of Cobalt. $Co S, C S_2$ Soluble in water.

SulphoCarbonate of Copper. $Cu S, C S_2$ Soluble in a solution of sulphocarbonate of calcium. (Berzelius.)

SulphoCarbonate of Ethyl.

(TerSulphoCarbonate of Ethyl. SulphoCarbonylSulphate of Ethyl.)

I.) Very sparingly soluble in water. Readily soluble in alcohol, and ether. (Schweitzer.)

$C_{10} H_{10} S_6 = \left. \begin{matrix} C_4 H_5 S \\ C_4 H_5 S \end{matrix} \right\} C_2 S_4$

II.) Not isolated.

$C_6 H_6 S_6 = \left. \begin{matrix} C_4 H_5 S \\ H S \end{matrix} \right\} C_2 S_4$

(SulphoXanthic Acid. EthylSulphoCarbonic Acid(of Kolbe).)

SulphoCarbonate of Ethyl & of Potassium. Soluble in water, and alcohol. Decomposes at 100°. (Chancel.)

$\left. \begin{matrix} C_4 H_5 S \\ K S \end{matrix} \right\} C_2 S_4$

"***Mono*SulphoCarbonate of Ethyl.**" *Vid.* EthylSulphoCarbonate of Ethyl.

***Di*SulphoCarbonate of Ethyl.** *Vid.* OxySulphoCarbonate of Ethyl.

SulphoCarbonate of Glucina. Apparently soluble in water. (Berzelius, *Lehrb.*)

SulphoCarbonate of Gold. Ppt.
$Au S_3, 3 C S_2$

SulphoCarbonate of Iron (*Ferrous*). Partially soluble.
$Fe S, C S_2$

SulphoCarbonate of Iron (*Ferric*). Insoluble in water. (Berzelius.)
$Fe_2 S_3, 3 C S_2$

SulphoCarbonate of Lead. Ppt.
$Pb S, C S_2$

SulphoCarbonate of Lithium. Deliquescent. Easily soluble in water, and alcohol. (Berzelius.)
$Li S, C S_2$

SulphoCarbonate of Magnesium. A portion of it is easily soluble in water, while the remainder forms a basic salt insoluble in cold water, but soluble, with decomposition, and deposition of carbonate of magnesia, in boiling water. (Berzelius, *Lehrb.*, **3.** 460.)
$Mg S, C S_2$

SulphoCarbonate of Manganese. Sparingly soluble in water. (Berzelius.)
$Mn S, C S_2$

SulphoCarbonate *of disulphide* of Mercury. Ppt.
$Hg_2 S, C S_2$

SulphoCarbonate *of protosulphide* of Mercury. Ppt. Soluble in an aqueous solution of sulphocarbonate of calcium. (Berzelius.)
$Hg S, C S_2$

SulphoCarbonate of Methyl. Scarcely at all soluble in water. Miscible in all proportions with alcohol, and ether. (Cahours.)
(*Tri SulphoCarbonate of Methyl. SulphoCarbonyl Sulphate of Methyl.*)
$C_6 H_6 S_6 = \left.\begin{matrix}C_2 H_3 S\\ C_2 H_3 S\end{matrix}\right\} C_2 S_4$

"*Mono*SulphoCarbonate of Methyl." *Vid.* MethylSulphoCarbonate of Methyl.

*Di*SulphoCarbonate of Methyl. *Vid.* OxySulphoCarbonate of Methyl.

SulphoCarbonate of Nickel. Soluble in water.
$Ni S, C S_2$

SulphoCarbonate of Platinum($Pt S_2$). Ppt. Soluble in an aqueous solution of sulphocarbonate of calcium. (Berzelius.)
$Pt S_2, 2 C S_2$

SulphoCarbonate of Potassium. Exceedingly hygroscopic. Readily soluble in water. Sparingly soluble in alcohol. (Berzelius.)
$K S, C S_2$

SulphoCarbonate of Silver. Soluble in an aqueous solution of sulphocarbonate of calcium.
$Ag S, C S_2$

SulphoCarbonate of Sodium. Deliquescent. Soluble in water, and alcohol. (Berzelius.)
$Na S, C S_2$

SulphoCarbonate of Strontium. More soluble in water than the barium salt. (Berzelius.)
$Sr S, C S_2$

SulphoCarbonate *of protosulphide* of Tin. Ppt.
$Sn S, C S_2$

SulphoCarbonate *of bisulphide* of Tin. Ppt.
$Sn S, 2 C S_2$

SulphoCarbonate of Uranium. Sparingly soluble in water.
$Ur_2 S_3, C S_2$

SulphoCarbonate of Zinc. Insoluble in water.
$Zn S, C S_2$

*Di*SulphoCarbonic Acid. *Vid.* OxySulphoCarbonic Acid.

SulphoCarbonidic Acid.
(*Bin OxySulphoCarbonic Acid. Persulfure de l'Acide diSulfoCarbonique.*)
$\Big(\begin{matrix}C_2 O_4\\ C_2 S_4\end{matrix}\Big\}\begin{matrix}H S_2\\ H S_2\end{matrix}$ of Gerhardt.)
$C_2 H S_4 O_2 = \left.\begin{matrix}C_2 S_4\\ H\end{matrix}\right\} O_2$

SulphoCarbonidate of Amyl. Insoluble in water. Soluble in alcohol.
(*Bin OxySulphoCarbonate of Amyl. PersulfureAmyl diSulfoCarbonique.*)
$\Big(\begin{matrix}C_2 O_4\\ C_2 S_4\end{matrix}\Big\}\begin{matrix}C_{10} H_{11} S_2\\ C_{10} H_{11} S_2\end{matrix}\Big)$(of Gerhardt).
$C_{12} H_{11} S_4 O_2 = \left.\begin{matrix}C_2 S_4\\ C_{10} H_{11}\end{matrix}\right\} O_2$

SulphoCarbonidate of Ethyl. Insoluble in water. Readily soluble in absolute alcohol, and in ether. (Debus.)
(*Bin OxySulphoCarbonate of Ethyl. PerSulfureEthyl diSulphoCarbonique.*)
$\Big(\begin{matrix}C_2 O_4\\ C_2 S_4\end{matrix}\Big\}\begin{matrix}C_4 H_5 S_2\\ C_4 H_5 S_2\end{matrix}$ of Gerhardt.)
$C_6 H_5 S_4 O_2 = \left.\begin{matrix}C_2 S_4\\ C_4 H_5\end{matrix}\right\} O_2$

SulphoCarbonidate of Methyl. Soluble in dilute wood-spirit. (Desains.)
(*Bin OxySulphoCarbonate of Methyl.*)
$C_4 H_3 S_4 O_2 = \left.\begin{matrix}C_2 S_4\\ C_2 H_3\end{matrix}\right\} O_2$

SulphoCarbonylAllylPhenyl*bi*amid. *Vid.* PhenylThiosinamin.

SulphoCarbonylic Acid.
(*MonoSulphoCarbonic Acid*(of Gerhardt).
$C_2 H_2 S_2 O_4 = \left.\begin{matrix}H S\\ H S\end{matrix}\right\} C_2 O_4$, or $\left.\begin{matrix}C_2 S_2''\\ H_2\end{matrix}\right\} O_4$

SulphoCarbonylate of Ethyl. *Vid.* Ethyl SulphoCarbonic Acid; and EthylSulphoCarbonate of Ethyl.

SulphoCarbonylSulphate of *X*. *Vid.* SulphoCarbonate of *X*.

SulphoCarbovinic Acid. *Vid.* OxySulphoCarbonate of Ethyl.

SulphoCerosate of Baryta. Very soluble in water. (Lewy, *Ann. Ch. et Phys.*, (3.) **13.** 457.)

SulphoChloride of *X*. *Vid.* Chloride of *X* with Sulphide of *X*.

SulphoChlorIsatin. Insoluble in water. Insoluble, or very sparingly soluble in weak spirit. Insoluble in bisulphide of carbon. (Erdmann.)
$C_{16} H_5 Cl N S_4 = N \left\{\begin{matrix}C_{16} H_3 Cl S_4''\\ H_2\end{matrix}\right.$

SulphoChloroNaphthalic Acid. *Vid.* ChloroSulphoNaphthalic Acid.

SulphoCinnamic Acid. Hygroscopic. Readily soluble in water, and alcohol. Most of the sulphocinnamates are soluble in water.
$C_{18} H_8 S_2 O_{10} = C_{18} H_6 O_2, 2 H O, 2 S O_3, \& + 6 Aq$

SulphoCinnamate of Ammonia & of Baryta.

SulphoCinnamate of Baryta.

I.) *normal.* Permanent. Almost insoluble in water. (Herzog.)
$C_{18} H_6 Ba_2 S_2 O_{10} + 2 Aq$

II.) *acid.* Permanent. Sparingly soluble in water, and alcohol. (Herzog.)
$C_{18} H_7 Ba S_2 O_{10} + 2 Aq$

SulphoCinnamate of Copper. Easily soluble in water.

SulphoCinnamate of Potash.

I.) *normal.* Hygroscopic. Readily soluble in water. Very difficultly soluble in alcohol. (Herzog.)
$C_{18} H_6 K_2 S_2 O_{10}$

II.) *acid.* Soluble in water. Very difficultly soluble in alcohol. (Herzog.)
$C_{18} H_7 K S_2 O_{10}$

SulphoCinnamate of Silver. Easily soluble in hot water, in ammonia-water, and in nitric acid. (Herzog.)
$C_{18} H_6 Ag_2 S_2 O_6$

SulphoCinnamate of Zinc.

SulphoCinnamid. Insoluble in water. Difficultly soluble in alcohol. Easily soluble in ether. (Herzog, cited in Wittstein's *Handw.*)

SulphoCumolic Acid. *Vid.* CumenylSulphurous Acid.

SulphoCyanhydric Acid. Soluble in water, the solution undergoing partial decomposition when boiled. The saturated aqueous solution is of 1.022 sp. gr. Soluble in alcohol. (Porrett, *Phil. Trans.*, 1814, p. 548.) Most of the sulphocyanides are soluble in water, and alcohol.

$C_2HNS_2 = \left.\begin{matrix}Cy\\H\end{matrix}\right\}S_2$

SulphoCyanhydrate of Aconitin.

SulphoCyanhydrate of Ammonium. Easily soluble in water, more difficultly soluble in alcohol, and still less soluble in ether. The aqueous solution undergoes decomposition after a time. (Zeise.)

$NH_4S,\ \left.\begin{matrix}Cy\\H\end{matrix}\right\}S_2$

SulphoCyanhydrate of Anilin.

$N\left\{\begin{matrix}C_{12}H_5\\H_2\end{matrix}\right. .\ HS,\ CyS$

SulphoCyanhydrate of AzoNaphthylamin. Appears to be readily soluble in water.

SulphoCyanhydrate of Beberin.

SulphoCyanhydrate of Brucin. Tolerably soluble in water. (Dolfuss.)

$N_2\left\{C_{46}H_{26}O_8^{vi}\right. .\ HS,\ CyS$

SulphoCyanhydrate of Cinchonin.

$N_2\left\{C_{40}H_{24}O_2^{vi}\right. .\ HS,\ CyS$

SulphoCyanhydrate of Codein. Somewhat soluble in alcohol.

$N\left\{\begin{matrix}C_{36}H_{20}O_6''\\H\end{matrix}\right. .\ HS,\ CyS + Aq$

SulphoCyanhydrate of Morphine.

$N\left\{\begin{matrix}C_{34}H_{18}O_6''\\H\end{matrix}\right. .\ HS,\ CyS$

SulphoCyanhydrate of Quinine.

$N_2\left\{C_{40}H_{24}O_4^{vi}\right. .\ HS,\ HS,\ 2\,CyS$

SulphoCyanhydrate of Sinapin. Soluble in water, alcohol, and aqueous alkaline solutions. (Henry & Garot.) Sparingly soluble in cold, readily soluble in boiling water, and spirit. Very sparingly soluble in absolute alcohol. Almost insoluble in ether. Soluble in ether, bisulphide of carbon, and oil of turpentine. (Simon.)

(*SulphoSinapisin. Sinapin*(of Berzelius).)

$N\left\{C_{32}H_{23}O_{10}\right. .\ HS,\ CyS$

SulphoCyanhydrate of Strychnine. Somewhat sparingly soluble in cold water. (Dolfuss.)

$N_2\left\{C_{42}H_{22}O_4^{vi}\right. .\ HS,\ CyS$

SulphoCyanide of Allyl. Sparingly soluble in water. (Wittstock.) Soluble in all proportions in alcohol, and ether. (Dumas; Pelouze.) Rectified essence of mustard is soluble in 50 pts. of water; and very easily soluble in alcohol, and ether. (Wittstein's *Handw.*)

(*Essence of Mustard.*)

$C_6H_5NS_2 = \left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2$

SulphoCyanide of Allyl with Sulphydrate of Ammonium.

$\left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2;\ NH_4S,\ HS$

SulphoCyanide of Allyl with Sulphydrate of Barium. Soluble in water, and alcohol.

$\left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2;\ BaS,\ HS + 4\,Aq$

SulphoCyanide of Allyl with Sulphydrate of Lead. Insoluble, or very sparingly soluble, in cold water.

$\left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2;\ PbS,\ HS$

SulphoCyanide of Allyl with Sulphydrate of Lime. Soluble in water, and alcohol.

SulphoCyanide of Allyl with Sulphydrate of Potassium. Soluble in water, and alcohol.

$\left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2;\ KS,\ HS$

SulphoCyanide of Allyl with Sulphydrate of Sodium. Soluble in water, and alcohol.

$\left.\begin{matrix}C_6H_5\\Cy\end{matrix}\right\}S_2;\ NaS,\ HS + 6\,Aq$

SulphoCyanide of AllylAmmonium. *Vid.* Thiosinnamin.

SulphoCyanide of Aluminum.

I.) "*octahedrons.*" Permanent. [Soluble in alcohol?] (Porrett, *Phil. Trans.*, 1814, p. 552.)

II.) *normal.* Soluble in water, but the solution is decomposed by evaporation. (Rammelsberg, in *Berzelius's Lehrb.*) Soluble in water. (Meitzendorff.)

$C_6N_6Al_2S_6 = \left.\begin{matrix}Cy_3\\Al_2'''\end{matrix}\right\}S_6$

III.) *basic.* Insoluble in water. Soluble in a boiling aqueous solution of caustic potash. Only slightly attacked by acids. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 72.)

SulphoCyanide of Ammonium. Deliquescent. Soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Less deliquescent than the sodium salt. Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 67.)

$C_2H_4N_2S_2 = \left.\begin{matrix}Cy\\NH_4\end{matrix}\right\}S_2$

SulphoCyanide of Ammonium & of Silver. Decomposed by water.

SulphoCyanide of Ammonium & of Platinum. Soluble in water, and alcohol. (Buckton.)

$C_6H_4N_4PtS_6 = \left.\begin{matrix}Cy\\NH_4\end{matrix}\right\}S_2;\ \left.\begin{matrix}Cy_2\\Pt\end{matrix}\right\}S_4$

SulphoCyanide of Amyl. Miscible in all proportions with alcohol, and ether; but separates from these solutions on the addition of water, in which it is nearly insoluble. (Medlock, *J. Ch. Soc.*, **1.** 375.) Soluble, with slight decomposition, in concentrated sulphuric acid; it is precipitated from this solution on the addition of water. Unacted upon by concentrated chlorhydric acid, by aqua-regia, or by ammonia-water, either hot or cold. Slightly attacked by a concentrated aqueous solution of caustic potash. (O. Henry, *Ann. Ch. et Phys.*, (3.) **25.** 248.)

$C_{12}H_{11}NS_2 = \left.\begin{matrix}Cy\\C_{10}H_{11}\end{matrix}\right\}S_2$

SulphoCyanide of Barium. Deliquescent. Soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Deliquescent. Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 68.)

$C_2BaNS_2 + 2\,Aq = \left.\begin{matrix}Cy\\Ba\end{matrix}\right\}S_2 + 2\,Aq$

SulphoCyanide of Barium & of Mercury.

"**SulphoCyanide of Benzoyl.**" *Vid.* Hydrate of SulphoCyanoBenzoyl.

$C_{16}H_5NS_2$

SulphoCyanide of Bismuth.

I.) *normal.* Insoluble, or very sparingly soluble, in water. When recently precipitated, it is decomposed by boiling with water, but after having been dried, this decomposition is very difficult. Soluble in sulphocyanhydric acid, also soluble in nitric and chlorhydric acids. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** pp. 83-85.) Sulphocyanide of bismuth appears to

$C_6BiN_3S_6 = \left.\begin{matrix}Cy_3\\Bi'''\end{matrix}\right\}S_6$

be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.)

II.) *basic.* (*OxySulpho Cyanide of Bismuth.*) $\left.\begin{matrix}Cy_3\\Bi'''\end{matrix}\right\}S_6\ ;\ 4\,Bi\,O_3 + 4\,Aq$ Insoluble in water, but is decomposed, when recently precipitated, by washing and boiling with water. After having been dried, this decomposition is very difficult. Insoluble in sulphocyanhydric acid. (Meitzendorff, *Pogg. Ann.*, **56**. pp. 83, 85.)

SulphoCyanide of Cadmium. $C_2\,Cd\,N\,S_2 = \left.\begin{matrix}Cy\\Cd\end{matrix}\right\}S_2$ Difficultly soluble in water. Soluble, with combination, in ammonia-water. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 81.)

SulphoCyanide of Cadmiumammonium. $C_2\,H_3\,Cd\,N_2\,S_2 = N\left\{\begin{matrix}Cy\\H_3\\Cd\end{matrix}\right\}S_2$ Decomposed by water. Soluble in ammonia-water. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 82.)

SulphoCyanide of Calcium. $C_2\,Ca\,N\,S_2 + 3\,Aq = \left.\begin{matrix}Cy\\Ca\end{matrix}\right\}S_2 + 3\,Aq$ Deliquescent. Soluble in water, and alcohol. (Porrett, *Phil. Trans.*, 1814, p. 552.) Very deliquescent. Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 71.)

SulphoCyanide of Calcium & of Mercury.

SulphoCyanide *of sesquioxide* **of Chromium.** Very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.)

SulphoCyanide of Cobalt. $C_2\,Co\,N\,S_2 = \left.\begin{matrix}Cy\\Co\end{matrix}\right\}S_2$ Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 77.)

SulphoCyanide of Cobaltammonium. $C_2\,H_3\,Co\,N_2\,S_2 = N\left\{\begin{matrix}Cy\\H_3\\Co\end{matrix}\right\}S_2$ There are two compounds:

I.) *Crystalline.* Deliquescent. Soluble in water, and alcohol.

II.) *Brownish-red powder.* Soluble in water. Insoluble in alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 77.)

*Di***SulphoCyanide of Copper.** $C_2\,Cu_2\,N\,S_2 = \left.\begin{matrix}Cy\\Cu_2\end{matrix}\right\}S_2$ Insoluble in water, and in most acids. Decomposed by aqueous solutions of the caustic alkalies. (Porrett, *Phil. Trans.*, 1814, p. 552.) Insoluble in water or dilute acids. Very slightly acted upon by cold, soluble in warm concentrated chlorhydric acid; from this solution dichloride of copper separates out if the acid is not present in excess. Decomposed by warm concentrated sulphuric acid, and by strong nitric acid. Soluble, with combination, in ammonia-water. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. pp. 86, 87.) Insoluble in an aqueous solution of sulphocyanide of potassium.

*Proto***SulphoCyanide of Copper.** $C_2\,Cu\,N\,S_2 = \left.\begin{matrix}Cy\\Cu\end{matrix}\right\}S_2$ Somewhat soluble. Readily decomposed to the di-salt when in presence of water. Very slightly acted upon by cold, soluble in warm concentrated chlorhydric acid. Also soluble in warm concentrated sulphuric acid, and in strong nitric acid. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 88.) Soluble in aqueous solutions of the alkaline sulphocyanides, but the solutions thus obtained are decomposed when largely diluted with water. Soluble, with combination, in ammonia-water.

*Di***SulphoCyanide of Copper with** *proto-***SulphoCyanide of Copper.** $C_4\,Cu_3\,N_2\,S_4 = \left.\begin{matrix}Cy\\Cu_2\end{matrix}\right\}S_2,\ \left.\begin{matrix}Cy\\Cu\end{matrix}\right\}S_2$ Permanent. Insoluble in an aqueous solution of sulphocyanide of potassium. Unacted upon by chlorhydric acid, even when this is hot. Decomposed by nitric acid. (Hull.)

SulphoCyanide of Cupr(*ic*)ammonium. $C_2\,H_3\,Cu\,N_2\,S_2 = N\left\{\begin{matrix}Cy\\H_3\\Cu\end{matrix}\right\}S_2$ Soluble in a small quantity of water, but is decomposed by much water, with evolution of ammonia, and separation of a basic salt. Soluble in ammonia-water, from which it is precipitated on the addition of absolute alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56**. 93.)

SulphoCyanide of Cupr(*eous*)ammonium. *Ibid.*, p. 88.)

SulphoCyanide of Ethyl. $C_6\,H_5\,N\,S_2 = \left.\begin{matrix}Cy\\C_4\,H_5\end{matrix}\right\}S_2$ Insoluble in water. Soluble in all proportions in alcohol, and ether. (Cahours, *Ann. Ch. et Phys.*, (3.) **18**. 264.) Quickly decomposed by warm concentrated nitric acid, the statement of Cahours, that it dissolves therein without change, being an error. (Muspratt.)

SulphoCyanide of Ethylene. $C_8\,H_4\,N_2\,S_4 = \left.\begin{matrix}Cy_2\\C_4\,H_4''\end{matrix}\right\}S_4$ Somewhat soluble in boiling, less soluble in cold water. Easily soluble in warm alcohol. (H. L. Buff, *Ann. Ch. u. Pharm.*, **96**. 302.) Very soluble in warm, less soluble in cold alcohol. Soluble in chloride of ethylene. (Sonnenschein.) Miscible with anilin, without decomposition, at temperatures below 100°. Very easily soluble, without decomposition, in very dilute nitric acid; decomposed by strong nitric acid. (Buff, *Ibid.*, **100**. 231.) Soluble in ether.

*Proto***SulphoCyanide of Gold.** $C_2\,Au\,N\,S_2 = \left.\begin{matrix}Cy\\Au\end{matrix}\right\}S_2$ Soluble in ammonia-water. (Grotthus.)

*Ter***SulphoCyanide of Gold.** $C_6\,N_3\,Au\,S_6 = \left.\begin{matrix}Cy_3\\Au\end{matrix}\right\}S_6$ Soluble in an aqueous solution of sulphocyanide of potassium, and in ammonia-water. Partially decomposed by aqueous solutions of the fixed caustic alkalies. (Grotthus.)

SulphoCyanide of Harmalin. Sparingly soluble in cold, more soluble in boiling water.

SulphoCyanide of Harmin. Sparingly soluble in water.

*Proto***SulphoCyanide of Iron.** $C_2\,Fe\,N\,S_2 + 3\,Aq = \left.\begin{matrix}Cy\\Fe\end{matrix}\right\}S_2 + 6\,Aq$ Very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Very easily oxidized when exposed to the air. Easily soluble in water, alcohol, and ether. (Claus, *Ann. Ch. u. Pharm.*, **99**. 48.)

*Sesqui***SulphoCyanide of Iron.** $C_6\,Fe_2\,N_3\,S_6 + 3\,Aq = \left.\begin{matrix}Cy_3\\Fe_2'''\end{matrix}\right\}S_6 + 3\,Aq$ Deliquescent. Very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Soluble in water, and in absolute alcohol. (v. Grotthus.)

Readily soluble in water, alcohol, and ether. Ether extracts it from the aqueous solution. When a concentrated aqueous solution is diluted with much water it decomposes, becoming colorless. This does not occur when alcohol is substituted for the water. The color of the solution is destroyed on the addition of alkalies, or of salts which have an alkaline reaction. The aqueous solution is not decolorized by monobasic acids, like chlorhydric, sulphuric, nitric, boracic, or the fatty acids. A large excess of concentrated sulphuric acid decomposes it, however. On the other hand, polybasic acids, like tartaric, malic, lactic, and especially oxalic and phosphoric acids, destroy the color of its solutions. On the addition of a considerable excess of chlorhydric acid the original color is usually restored, excepting in the cases of oxalic or phosphoric acid. (Claus, *Ann. Ch. u. Pharm.*, **99.** 53.) The solution obtained by dissolving recently precipitated sesquioxide of iron in sulphocyanhydric acid, suffers partial decomposition when evaporated upon the water-bath, the residue being no longer completely soluble in water. By repeated evaporation the salt may be almost completely decomposed, so that when treated with water the latter is scarcely at all colored. The insoluble residue appears to be pure hydrated oxide of iron, and not a basic sulphocyanide. A similar decomposition occurs when a dilute aqueous or alcoholic solution of the salt is boiled. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 80.)

SulphoCyanide of Lead.

I.) *normal.* Almost insoluble in cold water; boiling water decomposes it, with separation of an insoluble powder. (Liebig.) According to Porrett (*Phil. Trans.*, 1815, p. 553), it crystallizes in obtuse rhombs, which are slowly deliquescent, and soluble in water. Berzelius (*Lehrb.*, **3.** 718) maintains that the statement of Porrett is erroneous, while Gmelin (*Handbook*, **8.** 88) refers to a similar statement by Brandes. (*Taschenbuch*, 1849, p. 192.)

$$C_2 Pb N S_2 = \left.\begin{matrix}Cy\\Pb\end{matrix}\right\} S_2$$

II.) *basic.* Perfectly insoluble in water. (Liebig.)

(*OxySulphoCyanide of Lead.*)

$$\left.\begin{matrix}Cy\\Pb\end{matrix}\right\} S_2, Pb O, H O$$

SulphoCyanide of Magnesium. Deliquescent. Soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 71.)

$$C_2 Mg N S_2 + 4 Aq = \left.\begin{matrix}Cy\\Mg\end{matrix}\right\} S_2 + 4 Aq$$

SulphoCyanide of Magnesium & of Mercury.

SulphoCyanide of Manganese. Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 73.) Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Deliquescent. Soluble in water. Nearly insoluble in absolute alcohol. (Grotthus.)

$$C_2 Mn N S_2 + 3 Aq = \left.\begin{matrix}Cy\\Mn\end{matrix}\right\} S_2 + 3 Aq$$

***Di*SulphoCyanide of Mercury.** Insoluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Insoluble in cold, decomposed by boiling water. When boiled with concentrated chlorhydric acid, a small portion of it dissolves, and may be reprecipitated by adding water. Unacted upon by aqua-regia, unless this has been prepared from concentrated acids, in which case it very slowly decomposes the salt; if the acid, after having been boiled with the salt for some time, be diluted with water, a portion of the sulphocyanide will be precipitated from it unchanged. (Berzelius, *Lehrb.*)

$$C_2 Hg_2 N S_2 = \left.\begin{matrix}Cy\\Hg_2\end{matrix}\right\} S_2$$

***Proto*SulphoCyanide of Mercury.**

I.) *normal.* Very sparingly soluble in cold, rather more soluble in hot water. Easily soluble in alcohol, and in dilute chlorhydric acid. (Crookes, *J. Ch. Soc.*, **4.** 18.)

$$C_2 Hg N S_2 = \left.\begin{matrix}Cy\\Hg\end{matrix}\right\} S_2$$

II.) *basic.* Only slightly acted upon by aqueous acids, or alkaline solutions. (Claus.) Berzelius obtained an analogous compound, soluble in chlorhydric acid, from which it is precipitated on the addition of water.

(*OxySulphoCyanide of Mercury.*)

$$Cy S, Hg S, 2 Hg O$$

SulphoCyanide of Mercury & of Potassium. Soluble in cold, and more readily in hot water. Readily soluble in alcohol, especially when hot, and in ether. Very easily soluble in aqueous solutions of chloride of ammonium and chloride of potassium. (Claus.)

$$C_6 Hg_2 K N_3 S_6 = 2\left(\left.\begin{matrix}Cy\\Hg\end{matrix}\right\} S_2\right); \left.\begin{matrix}Cy\\K\end{matrix}\right\} S_2$$

SulphoCyanide of Methyl. Very slightly soluble in water. Soluble in all proportions in alcohol, and ether. Soluble, without decomposition, in warm tolerably concentrated nitric acid, separating out, unchanged, as the solution cools. (Cahours, *Ann. Ch. et Phys.*, (3.) **18.** 261.)

$$C_4 H_3 N S_2 = \left.\begin{matrix}Cy\\C_2 H_3\end{matrix}\right\} S_2$$

SulphoCyanide of MethylNicotine. Soluble in water.

SulphoCyanide of Molybdenum. Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.)

$$C_2 Mo N S_2 = \left.\begin{matrix}Cy\\Mo\end{matrix}\right\} S_2$$

SulphoCyanide of Naphthyl. *Vid.* NaphtoylSulphoCarbamid.

SulphoCyanide of Nickel. Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 78.) Also, with combination, in ammonia-water.

$$C_2 Ni N S_2 = \left.\begin{matrix}Cy\\Ni\end{matrix}\right\} S_2$$

SulphoCyanide of NickelBiamin. Slowly efflorescent. Decomposed by water. Soluble in ammonia-water. (Meitzendorff, *Pogg. Ann.*, 1842, **56.** 79.)

$$C_2 H_6 Ni N_3 S_2 = \left.N_2\left\{\begin{matrix}Cy\\H_6 . Ni\end{matrix}\right.\right\} S_2$$

SulphoCyanide of NitroHarmalin. Sparingly soluble in water.

SulphoCyanide of NitroHarmin. Soluble in warm water.

SulphoCyanide of Palladium. Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.)

$$C_2 Pd N S_2$$

SulphoCyanide of Phenyl.

(*SulphoCarbonylPhenylamide.*)

$$C_{14} H_5 N S_2 = \left.\begin{matrix}C_{12} H_5\\C_2 N\end{matrix}\right\} S_2$$

SulphoCyanide of PhenylNaphthylamin. Very sparingly soluble in alcohol, and ether. (Hofmann.)

(*PhenylNaphthylSulphoCarbamid.*)

$$C_{34} H_{14} N_2 S_2 = N \left\{\begin{matrix}C_{20} H_8''\\C_{12} H_5\end{matrix}\right., H Cy S_2$$

SulphoCyanide of Platin(*ous*)*bi*amin & of Platinum. Completely insoluble in water, or alcohol. Soluble in dilute chlorhydric acid.

(*SulphoCyanide of diPlatosammonium & of Platinum.*)

$$C_4 H_6 Pt_2 N_4 S_4 = N_2 \left\{ H_6 . Pt', Cy S_2 ; Pt Cy S_2\right.$$

SulphoCyanide of Platin(*ous*)ammonium. (*SulphoCyanide of Platosammonium.*) Soluble in water. The aqueous solution undergoes partial decomposition when boiled for a long time. More soluble in alcohol than in water. (Buckton, *J. Ch. Soc.*, 7. 38.)

$C_2\ H_3\ Pt\ N_2 S_2 = N \left\{ \begin{matrix} H_3 \\ Pt' \end{matrix} \right. . Cy\ S_2$

*Proto***SulphoCyanide of Platinum.** Insoluble in water, or alcohol. Soluble in dilute acids, and in aqueous solutions of the metallic chlorides, from which it is precipitated on the addition of water, or alcohol. (Grotthus.) Unacted upon by an aqueous solution of caustic potash.

$C_2\,Pt\,N\,S_2 = \left. \begin{matrix} Cy \\ Pt \end{matrix} \right\} S_2$

*Bi***SulphoCyanide of Platinum.** Insoluble in water. Soluble in aqueous solutions of chloride of potassium, chloride of sodium, and chloride of ammonium, also in acids.

$C_4\,Pt\,N_2\,S_4 = \left. \begin{matrix} Cy_2 \\ Pt \end{matrix} \right\} S_4$

SulphoCyanide of Platinum & of Potassium. (Claus, *Beiträge*, p. 40.)

$\left. \begin{matrix} Cy_2 \\ Pt \end{matrix} \right\} S_4 ; \left. \begin{matrix} Cy \\ K \end{matrix} \right\} S_2$

SulphoCyanide of Platosammonium. *Vid.* SulphoCyanide of Platin(*ous*)ammonium.

SulphoCyanide of Potassium. Deliquescent. Soluble in water, and alcohol. (Porrett, *Phil. Trans.*, 1814, p. 552.) Abundantly soluble in water, with reduction of temperature; somewhat less soluble in spirit, but very soluble in boiling alcohol.

$C_2\,K\,N\,S_2 = \left. \begin{matrix} Cy \\ K \end{matrix} \right\} S_2$

SulphoCyanide of Potassium & of Silver. Permanent. Decomposed by water. (Hull.)

$C_4\,K\,Ag\,N_2\,S_4 = \left. \begin{matrix} Cy \\ K \end{matrix} \right\} S_2 ; \left. \begin{matrix} Cy \\ Ag \end{matrix} \right\} S_2$

SulphoCyanide of Silver. Insoluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Insoluble in water, or in acids, excepting concentrated sulphuric and nitric acids. (Liebig.) Soluble in an aqueous solution of protonitrate of mercury. (Wackenroder, *Ann. Ch. u. Pharm.*, 41. 317.) Insoluble in dilute ammonia-water. (Berzelius, *Lehrb.*) Soluble in ammonia-water, and in a solution of sulphocyanide of potassium. Insoluble in aqueous solutions of nitrate of silver, or sulphocyanide of ammonium, or in nitric acid. (Aschoff.)

$C_2\,Ag\,N\,S_2 = \left. \begin{matrix} Cy \\ Ag \end{matrix} \right\} S_2$

SulphoCyanide of Sodium. Deliquescent. Soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Very deliquescent. Very easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, 56. 66.)

$C_2\,Na\,N\,S_2 = \left. \begin{matrix} Cy \\ Na \end{matrix} \right\} S_2$

SulphoCyanide of Strontium. Deliquescent. Soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 552.) Easily deliquescent. Easily soluble in water, and alcohol. (Meitzendorff, *Pogg. Ann.*, 1842, 56. 70.)

$C_2\ Sr\,N\,S_2 + 3\ Aq = \left. \begin{matrix} Cy \\ Sr \end{matrix} \right\} S_2 + 3\ Aq$

SulphoCyanide of Tin. Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.)

*Proto***SulphoCyanide of Uranium.** Deliquescent. Soluble in water. (Rammelsberg.)

$C_2\,Ur\,N\,S_2 = \left. \begin{matrix} Cy \\ Ur \end{matrix} \right\} S_2$

*Sesqui***SulphoCyanide of Uranium.** Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Insoluble in alcohol. (Brandes.)

$C_6\,Ur_2\,N_3\,S_6 + 2\ Aq = \left. \begin{matrix} 3\ Cy \\ Ur_2''' \end{matrix} \right\} S_6 + 2\ Aq$

SulphoCyanide of Yttrium. Deliquescent. Soluble in water. (Berlin.)

$C_2\,Yr\,N\,S_2 = \left. \begin{matrix} Cy \\ Yr \end{matrix} \right\} S_2$

SulphoCyanide of Zinc. Appears to be very soluble in water. (Porrett, *Phil. Trans.*, 1814, p. 553.) Soluble in water, and alcohol; somewhat less readily than many other of the sulphocyanides. Soluble in ammonia-water. (Meitzendorff, *Pogg. Ann.*, 1842, 56. 74.)

$C_2\,Zn\,N\,S_2 = \left. \begin{matrix} Cy \\ Zn \end{matrix} \right\} S_2$

SulphoCyanide of Zincammonium. Decomposed by water, with separation of oxide of zinc. Soluble in ammonia-water. (Weitzendorff, *Pogg. Ann.*, 1842, 56. 75.)

$C_2\,H_3\,Zn\,N_2\,S_2 = N \left\{ \begin{matrix} Cy \\ H_3 \\ Zn \end{matrix} \right\} S_2$

*Per***SulphoCyanhydric Acid.** (*HydroperSulphoCyanhydric Acid. Hydroxanthic Acid. Sulphuretted HydroSulphoCyanic Acid.*) Almost insoluble in cold, completely, though sparingly, soluble in boiling water. More soluble in alcohol, and ether, than in hot water. Soluble, without decomposition, in cold concentrated sulphuric acid, from which it is precipitated on the addition of water. Soluble in aqueous solutions of the alkalies, with separation of sulphur. The persulphocyanides corresponding to metallic sulphides which are not decomposed by dilute acids, are themselves not decomposable by these agents. (Vœlckel.)

$C_4\,H_2\,N_2\,S_6 = \left. \begin{matrix} Cy_2\,S_2'' \\ H_2 \end{matrix} \right\} S_4$

*Per***SulphoCyanide of Lead.**

I.) *normal.* Completely insoluble in water, alcohol, or weak acids. (Vœlckel.)

$Cy_2\,Pb_2\,S_6$

II.) *basic.* By the action of boiling acids it is converted into the normal compound (No. I.). (Vœlckel.)

$Cy_2\,Pb_2\,S_6 ; 2\,Pb\,O$

SulphoCyanoBenzylene. *Vid.* Hydride of SulphoCyanoBenzoyl.

*Per***SulphoCyanogen.** (*SulphoCyanogen. PseudoSulphoCyanogen. OxySulphide of Cyanogen.*) Insoluble in water, alcohol, or ether. (Vœlckel.) Soluble in warm concentrated sulphuric acid, from which it is precipitated unchanged on the addition of water. Also soluble, for the most part, in ammonia-water. (Liebig.) Insoluble in ammonia-water. (Wœhler.) Soluble in an aqueous solution of caustic potash, and readily, with decomposition, in sulphide of potassium. (Liebig.)

$C_6\,H\,N_3\,S_6 = \left. \begin{matrix} Cy_2\,S_2'' \\ H\,.\,Cy \end{matrix} \right\} S_4$

*Per***SulphoCyanogen with Lead.** Ppt. (Vœlckel.)

$C_6\,Pb_2\,H\,N_3\,S_6\,O_2 = \left. \begin{matrix} Cy_2\,S_2'' \\ Pb\,.\,Cy \end{matrix} \right\} S_4 + \left. \begin{matrix} Pb \\ H \end{matrix} \right\} O_2$

SulphoCyanogen *bihydrosulphurée.* *Vid.* BiSulphide of SulphoCarbammonium.

SulphoCyanoPlatinic Acid. *Vid.* Platino*ter*SulphoCyanhydric Acid.

SulphoCyanoPlatinous Acid. *Vid.* Platino*bi*SulphoCyanhydric Acid.

SulphoCymenic Acid. *Vid.* ThymylSulphurous Acid.

SulphoDraconic Acid. Soluble in water. (Laurent.)

SulphoDraconate of Baryta. Very soluble in water. Somewhat soluble in spirit. (Lallemand, *Ann. Ch. et Phys.*, (3.) 49. 150.)

$C_{20}\,H_{11}\,Ba\,S_2\,O_8$

SulphoDraconate of Lead. Very soluble in water. (Gerhardt.)

SulphoDraconate of Lime. Soluble in water.

SulphoDraconate of Silver. Soluble in water.

SulphoDracylic Acid. *Vid.* ToluenylSulphurous Acid.

SulphoEtholic Acid. *Vid.* SulphEtholic Acid.

SulphoFerrate of Iron. Known only in aqueous solution. The dilute solution may be boiled without undergoing decomposition, but a concentrated solution is decomposed by boiling. (H. Rose, in *Berzelius's Lehrb.*, **2.** 729; and **3.** 211.)

SulphoFlavic Acid. Soluble in water, and *(Indigo Yellow.)* alcohol. (Berzelius.)

SulphoFlavate of Lead. Insoluble in water.

Sulphoform. Very sparingly soluble in water. Soluble in alcohol, and ether. Decomposed by acids, and by alkaline solutions. (Bouchardat.)
C_2HS_3

SulphoFormic Acid. *Vid.* MethylSulphurous Acid.

SulphoFulvic Acid. Soluble in water, and in absolute alcohol.

SulphoFulvate of Lead. Readily soluble in water, and alcohol. (Berzelius.)

SulphoGlucicAcid. *Vid.* SulphoLignic Acid.

SulphoGlutinic Acid. Easily soluble in water, and alcohol; less easily soluble in ether.
(HypoSulphoGlutinic Acid.)

SulphoGlutinate of Soda. Soluble in water.

SulphoGlyceric Acid. Soluble in water, and in concentrated sulphuric acid. (Fremy.) All the metallic sulphoglycerates are very soluble in water. (Redtenbacher.)
$C_6H_8S_2O_{12} = C_6H_7O_5, HO, 2SO_3$

SulphoGlycerate of Baryta. Soluble in water.
$C_6H_7BaS_2O_{12}$

SulphoGlycerate of Lead. Easily soluble in water. (Pelouze.)
$C_6H_7PbS_2O_{12}$

SulphoGlycerate of Lime. Soluble in less than 1 pt. of cold water. Insoluble in alcohol or ether.
$C_6H_7CaS_2O_{12}$

SulphoGlycerate of Silver. Very soluble in water. (Pelouze.)

SulphoGlycolic Acid.
$C_4H_6S_2O_{10} = C_4H_3O_3, HO, 2SO_3$

SulphoGlycolate of Baryta. Somewhat deliquescent. Easily soluble in water. Nearly insoluble in absolute alcohol, and in ether. (Simpson.)
$C_4H_5BaS_2O_{10}$

SulphoHellenate of Baryta. Very soluble in water. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **12.** 191.)

SulphoLignic Acid; and

SulphoGlucic Acid. Both contain $C_{12}H_{12}O_{12} + x\,SO_3$; but since they are very unstable, it is not easy to determine their true composition.

I.) (*acid from cellulose.*) Very deliquescent.

Baryta Salt.

The Lead Salt is very deliquescent, and soluble in water. Insoluble in alcohol. (Blondeau.)

Lime Salt. Deliquescent. Easily soluble in water.
$C_{24}H_{23}CaS_2O_{30}$ (*as cited by* Weltzien.)

II.) (*acid from Starch.*)

Baryta Salt.

Lead Salt.

Lime Salt.

III.) (*acid from Glucose.*) Almost all of its salts are soluble in water.

SulphOleic Acid. Soluble in pure water. Insoluble in water which contains sulphuric acid. Decomposed after a while, when in contact with water. Soluble in alcohol. The sulpholeates of potash, soda, and ammonia, are soluble in water; but the other salts are insoluble in water, and only sparingly soluble in alcohol.

SulphoMannitic Acid. Soluble in water. (Favre, *Ann. Ch. et Phys.*, (3.) **11.** 77.)
(SulphoMannicylic Acid.)
$C_{12}H_{14}O_{12}, 6SO_3$

SulphoMannitate of Ammonia.

SulphoMannitate of Baryta. Soluble in water. Insoluble in alcohol. (Favre, *loc. cit.*)
$C_{12}H_{11}Ba_3O_{12}, 6SO_3$

SulphoMannitate of Copper. Readily soluble in water.

SulphoMannitate of Lead.

I.) Deliquescent.
$C_{12}H_{11}Pb_3O_{12}, 6SO_3$

II.) "*mono.*" Appears to be somewhat soluble in water. (Favre, *loc. cit.*)

III.) Insoluble in water. Very soluble in slightly acidulated water, the solution being slowly decomposed when boiled. (Favre, *loc. cit.*)
"$C_6H_5O_4, 4PbO, 2SO_3$"

SulphoMannitate of Lime. Soluble in water. Insoluble in alcohol.

SulphoMannitate of Potash. Very deliquescent.
$C_{12}H_{11}K_3O_{12}, 6SO_3$

SulphoMannitate of Silver.

SulphoMannitate of Soda.
$C_{12}H_{11}Na_3O_{12}, 6SO_3$

SulphoMargaric Acid. Soluble in pure water, and in alcohol. Insoluble in water which contains sulphuric acid. (Fremy.)

SulphoMellonic Acid. Scarcely at all soluble in cold water, in alcohol, or in ether. Sparingly soluble in boiling water. (Jamieson.)
(HydroThioMellon. HydroSulphoMellonic Acid. Ammelide Sulfuré.)

$$C_6H_4N_4S_4 = NCy\,H_2, 2CyHS_2 \text{ or } N_3\left\{\begin{matrix}(C_2S_2'')_2\\ C_2N\\ H_4\end{matrix}\right.$$

SulphoMellonate of Baryta. Very soluble in water.
$C_6H_3BaN_4S_4 + 5Aq$

SulphoMellonate of Lime. Soluble in water.
$C_6H_3CaN_4S_4 + 2Aq$

SulphoMellonate of Magnesia. Very soluble in water.
$C_6H_3MgN_4S_4 + 6Aq$

SulphoMellonate of Potash. Very soluble in water, and alcohol.
$C_6H_3KN_4S_4 + 3Aq$

SulphoMellonate of Silver. Completely insoluble in water.
$C_6H_3AgN_4S_4$

SulphoMellonate of Soda. Soluble in water, especially when this is hot.
$C_6H_3NaN_4S_4 + 3Aq$

SulphoMellonate of Strontia. Soluble in water.
$C_6H_3SrN_4S_4 + 4Aq$

SulphoMesitylic Acid (of Hofmann). *Vid.* MesitylSulphuric Acid.

SulphoMesitylic Acid. Deliquescent. Soluble in water, and in strong alcohol. (Hlasiwetz.) Soluble in water. (Kane.)

SulphoMesitylate of Baryta. Soluble in water.

SulphoMesitylate of Copper. Souble in water, and in boiling alcohol. (Hlasiwetz.)
$C_6 H_5 Cu S_2 O_6 + 2 Aq$

SulphoMesitylate of Lime. Soluble in water, and in alcohol. Ether precipitates it from the alcoholic solution. (Hlasiwetz.)
$C_6 H_5 Ca S_2 O_6$

Sulpho*per*Mesitylic Acid. Soluble in water. (Kane.)

Sulpho*per*Mesitylate of Baryta. Soluble in water.

Sulpho*per*Mesitylate of Lime. Deliquescent. Soluble in water. (Kane.)
$C_{12} H_{10} Ca_4 S_4 O_{15} + 2 Aq$

SulphoMesityloSulphuric Acid. *Vid.* SulphoMesitylic Acid.

SulphoMethylane. Sulphamate of Methyl.
$C_2 H_5 N S_2 O_6$

SulphoMethylic Acid. *Vid.* MethylSulphuric Acid.

SulphoMethylSulphuric Acid. *Vid.* MethylSulphurous Acid.

***Di*SulphoMetholic Acid.** *Vid.* Methionic Acid.

SulphoMolybdic Acid. *Vid.* *Ter*Sulphide of Molybdenum.

The alkaline sulphomolybdates, and those of the alkaline earths, are soluble in water, and the solutions are tolerably stable when concentrated, but they gradually undergo decomposition when dilute.

SulphoMolybdate of Ammonium.

I.) Easily soluble in water. Very sparingly soluble in alcohol. (Berzelius, *Lehrb.*)
$N H_4 S, Mo S_3$

II.) *acid.* Tolerably easily soluble in water. Very sparingly soluble in alcohol. (Berzelius, *Lehrb.*)

SulphoMolybdate of Baryta.

I.) More soluble in water than No. II.
$Ba S, Mo S_3$

II.) Less soluble in water than No. I. (Berzelius.) Not decomposed by cold concentrated chlorhydric acid, but is more readily attacked by dilute acid.
$Ba S, 3 Mo S_3$

SulphoMolybdate of Bismuth. Ppt.
$Bi S_3, 3 Mo S_3$

SulphoMolybdate of Cadmium. Insoluble in water. (Berzelius.)
$Cd S, Mo S_3$

SulphoMolybdate of Calcium.

I.) Permanent. More soluble in water than No. II.
$Ca S, Mo S_3$

II.) Permanent.
$Ca S, 3 Mo S_3$

SulphoMolybdate *of protosulphide* of Cerium.

I.) Insoluble in water.
$Ce S, Mo S_3$

SulphoMolybdate *of sesquisulphide* of Cerium. Partially soluble in water. (Berzelius.)
$Ce_2 S_3, 3 Mo S_3$

SulphoMolybdate of Chromium. Insoluble in water.
$Cr_2 S_3, 3 Mo S_3$

SulphoMolybdate of Cobalt. Soluble in an aqueous solution of sulphomolybdate of potassium. (Berzelius.)
$Co O, Mo S_3$

SulphoMolybdate of Copper. Ppt.
$Cu S, Mo S_3$

SulphoMolybdate of Glucinum. Soluble in water, but the aqueous solution gradually undergoes decomposition. (Berzelius, *Lehrb.*)
$Gl_2 S_3, 3 Mo S_3$

SulphoMolybdate of Gold. Soluble in water, from which it separates out after a time. (Berzelius, *Lehrb.*)
$Au S_3, 3 Mo S_3$

SulphoMolybdate of Iron.

I.) Soluble in water. (Berzelius.)
$Fe S, Mo S_3$

II.) Soluble in an aqueous solution of sulphomolybdate of potassium. (Berzelius.)
$Fe_2 S_3, 3 Mo S_3$

SulphoMolybdate of Lead. Ppt.
$Pb S, Mo S_3$

SulphoMolybdate of Lithium. Permanent. Very easily soluble in water.
$Li S, Mo S_3$

SulphoMolybdate of Magnesium. Soluble in an aqueous solution of bisulphide of molybdenum.
$Mg S, Mo S_3$

SulphoMolybdate of Manganese.

I.) *mono.* Soluble in water.
$Mn S, Mo S_3$

II.) *acid.* Insoluble in water.

III.) *basic.* Insoluble in water.

SulphoMolybdate *of disulphide* of Mercury. Ppt.
$Hg_2 S, Mo S_3$

SulphoMolybdate *of protosulphide* of Mercury. Ppt. Insoluble in an aqueous solution of sulphomolybdate of potassium. (Berzelius.)
$Hg S, Mo S_3$

SulphoMolybdate of Nickel. Permanent. Soluble in an aqueous solution of molybdate of potash. (Berzelius, *Lehrb.*)
$Ni S, Mo S_3$

SulphoMolybdate *of bisulphide* of Platinum. Ppt.
$Pt S_2, 2 Mo S_3$

SulphoMolybdate of Potassium.

I.) Soluble in water; less soluble in alcohol. (Berzelius.)
$K S, Mo S_3$

II.) Slowly soluble in cold, rapidly soluble in boiling water.
$K S, 3 Mo S_3$

SulphoMolybdate of Silver. Ppt.
$Ag S, Mo S_3$

SulphoMolybdate of Sodium.

I.) Soluble in water, and in alcohol. Much more soluble in alcohol than the potash-salt. (Berzelius.)
$Na S, Mo S_3$

II.) Difficultly soluble in water.
$Na S, 3 Mo S_3$

SulphoMolybdate of Strontium. Similar to the barium salts. (Berzelius.)

I.) $Sr S, Mo S_3$

II.) $Sr S, 3 Mo S_3$

SulphoMolybdate *of protosulphide* of Tin. Ppt.
$Sn S, Mo S_3$

SulphoMolybdate *of bisulphide* of Tin. Ppt.
$Sn S_2, 2 Mo S_3$

SulphoMolybdate *of sesquisulphide* of Uranium. Permanent. Insoluble in water. (Berzelius.)
$Ur_2 S_3, Mo S_3$

SulphoMolybdate of Yttrium. Appears to be soluble in water. (Berzelius, *Lehrb.*)
$Y S, Mo S_3$

SulphoMolybdate of Zinc. Insoluble in water. (Berzelius.)
$Zn S, Mo S_3$

PerSulphoMolybdic Acid. *Vid. quadri*-Sulphide of Molybdenum. The persulphomolybdates, with the exception of those of the alkalies, are insoluble in water. (Berzelius.)
$Mo S_4$

PerSulphoMolybdate of Ammonium. Slightly soluble in cold, more abundantly soluble in hot water. Totally insoluble in ammonia-water. (Berzelius.)
$N H_4 S, Mo S_4$

PerSulphoMolybdate of Baryta. Insoluble in water, but is decomposed when boiled with water. (Berzelius.)
$Ba S, Mo S_4$

PerSulphoMolybdate of Bismuth. Ppt.
$Bi S_3, Mo S_4$

PerSulphoMolybdate of Cadmium.

PerSulphoMolybdate of Calcium. Sparingly soluble in water; less soluble in alcohol. (Berzelius.)
$Ca S, Mo S_4$

PerSulphoMolybdate of Cerium. Insoluble in water.

PerSulphoMolybdate of Chromium. Insoluble in water.
$Cr_2 S_3, 3 Mo S_4$

PerSulphoMolybdate of Cobalt. Ppt.
$Co S, Mo S_4$

PerSulphoMolybdate of Copper. Ppt.
$Cu S, Mo S_4$

PerSulphoMolybdate of Glucinum. Ppt.
$Gl_2 S_3, Mo S_4$

PerSulphoMolybdate of Gold. Ppt.
$Au S_3, 3 Mo S_4$

PerSulphoMolybdate of Iron (*Ferrous*). Insoluble in aqueous solutions of the protosalts of iron, but soluble in a solution of persulphomolybdate of potassium. (Berzelius.)
$Fe S, Mo S_4$

PerSulphoMolybdate of Iron (*Ferric*). Ppt.

PerSulphoMolybdate of Lead. Ppt.
$Pb S, Mo S_4$

PerSulphoMolybdate of Lithium. Slightly soluble in cold, readily soluble in hot water. (Berzelius.)
$Li S, Mo S_4$

PerSulphoMolybdate of Magnesium. Insoluble in water. (Berzelius.)
$Mg S, Mo S_4$

PerSulphoMolybdate of Manganese. Insoluble in water.
$Mn S, Mo S_4$

PerSulphoMolybdate of Mercury.

I.) Ppt.
$Hg_2 S, Mo S_4$

II.) Ppt.
$Hg S, Mo S_4$

PerSulphoMolybdate of Nickel. Ppt. Soluble in an aqueous solution of persulphomolybdate of potassium, from which it separates after standing for some 24 hours. (Berzelius.)
$Ni S, Mo S_4$

PerSulphoMolybdate *of bisulphide* **of Platinum.** Ppt.
$Pt S_2, 2 Mo S_4$

PerSulphoMolybdate of Potassium. Very sparingly soluble in cold, but soluble in boiling water. Insoluble in a cold aqueous solution of caustic potash, or in cold chlorhydric acid. (Berzelius.)
$K S, Mo S_4$

PerSulphoMolybdate of Silver. Ppt.
$Ag S, Mo S_4$

PerSulphoMolybdate of Sodium. Sparingly soluble in cold, readily soluble in hot water. (Berzelius.)
$Na S, Mo S_4$

PerSulphoMolybdate of Strontium. Similar to the barium salt.
$Sr S, Mo S_4$

PerSulphoMolybdate *of protosulphide* **of Tin.** Ppt.
$Sn S, Mo S_4$

PerSulphoMolybdate *of bisulphide* **of Tin.** Sparingly soluble in water. Soluble in an aqueous solution of persulphomolybdate of potash. (Berzelius.)
$Sn S_2, 2 Mo S_4$

PerSulphoMolybdate *of sesquisulphide* **of Uranium.** Insoluble in water. (Berzelius.)
$Ur_2 S_3, Mo S_4$

PerSulphoMolybdate of Yttrium. Ppt.
$Y S, Mo S_4$

PerSulphoMolybdate of Zinc. Ppt.
$Zn S, Mo S_4$

SulphoMolybdous Acid. *Vid. bi*Sulphide of Molybdenum.

SulphoMorphine. (*SulphoMorphide.*) Sparingly soluble in water. Decomposed by boiling water. Insoluble in alcohol, and ether. Easily soluble in dilute acids; decomposed by concentrated acids, and by alkaline solutions.
$C_{68} H_{36} N_2 S_2 O_{16} = N_2 \left\{ \begin{matrix} (C_{34} H_{18} O_6'')_2 \\ S_2 O_4'' \end{matrix} \right.$

SulphoMuriatic Acid. *Vid.* Chloride of Sulphur.

SulphoNaphthalic Acid.
(*NaphtylSulphurous Acid. HypoSulphoNaphthalic Acid. Naphtyl diThionic Acid. SulphoNaphthamic Acid. Sulphite of Naphtoyl.*)

$a = C_{20} H_8 S_2 O_6 + 2 Aq$ Deliquescent. Readily soluble in water, and alcohol. It dissolves in melted naphthalin, in oil of turpentine, and olive-oil, the more readily in proportion as it is more nearly anhydrous. As a hydrate, it is almost insoluble in naphthalin. The hydrate melts in its water of crystallization, at a temperature lower than 100°. (Faraday, *Phil. Trans.*, 1826, **116**. pp. 147, 148.)

Its salts are all soluble in water, and most of them are soluble in alcohol also. (Faraday, *loc. cit.*) Very sparingly soluble in ether.

b. An isomeric modification, known as the "acid of Faraday's smouldering baryta salt," is readily soluble in water, but does not absorb moisture from the air. (Berzelius.)

SulphoNaphthalate of Ammonia. Permanent. Readily soluble in water, and alcohol. Its solutions are decomposed to a certain extent by evaporation. (Faraday, *Phil. Trans.*, 1826, **116**. 150.)

SulphoNaphthalate of Baryta.

a = ordinary. (*Flaming Salt, of Faraday.*) Permanent. Readily soluble in water, and alcohol, Insoluble in ether. It is not decomposed by moderately strong nitric acid, or aqua-regia, even when boiled with them, but decomposition occurs if it is treated with very strong acids. (Faraday, *Phil. Trans.*, 1826, **116**. 151.) 100 pts. of water at 15° dissolve only 1.13 pts. of it; at 100° they dissolve 4.76 pts. of it. Soluble in absolute alcohol, and in ether. (Gerhardt, *Tr.*, &c.)
$C_{20} H_7 Ba S_2 O_6 + 1 \text{ or } 2 Aq$

b = "*Glowing Salt,*" of Faraday. By no means so soluble in water, either hot or cold, as *a*. Soluble in alcohol. (Faraday, *loc. cit.*, pp. 153, 151, 146.)

SulphoNaphthalate of Copper.
a = acid.

SulphoNaphthalate of Ethyl. Insoluble in water. Mixes in all proportions, with alcohol, and ether. (Kimberly.)
$C_{24} H_{12} S_2 O_6 = C_{20} H_7 (C_4 H_5) S_2 O_6$

SulphoNaphthalate *of protoxide* of Iron. Slowly absorbs oxygen from the air. (Faraday, *Phil. Trans.*, 1826, **116**. 154.)

SulphoNaphthalate of Lead.

I.) *normal.*

a = $C_{20}\,H_7\,Pb\,S_2\,O_6$ Permanent. Soluble in water, and alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. 154.) Less soluble in water containing free acid than in pure water. More soluble in water than the baryta salt, the warm saturated solution solidifying on cooling. (Berzelius.)

b = *Isomeric modif.* Exactly like the *b* baryta salt. (Berzelius.)

II.) *di.* Less soluble in water than the normal

$C_{20}\,H_7\,Pb\,S_2\,O_6;\ Pb\,O$ salt. (Regnault.)

III.) *tetra.*

$C_{20}\,H_7\,Pb\,S_2\,O_6;\ 3\,Pb\,O$

IV.) *polybasic.* Insoluble in water. (Berzelius.)

SulphoNaphthalate of Lime. Slightly soluble in water. Soluble in alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. 154.)

SulphoNaphthalate of Magnesia. Soluble in water. (Faraday, *Phil. Trans.*, 1826, **116**. 154.)

SulphoNaphthalate of Manganese. Soluble in water, and alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. 154.)

SulphoNaphthalate *of dinoxide* of Mercury. Permanent. Partially soluble in water, and alcohol, with formation of a basic salt. (Faraday, *Phil. Trans.*, 1826, **116**. 155.)

SulphoNaphthalate *of protoxide* of Mercury. Deliquescent. (Faraday, *loc. cit.*)

SulphoNaphthalate of Nickel.

a = *normal.* Soluble in water. (Faraday, *Phil. Trans.*, 1826, **116**. 155.)

b = *basic.* Insoluble in water. (Faraday, *loc. cit.*)

SulphoNaphthalate of Potash.

a = $C_{20}\,H_7\,K\,S_2\,O_6 + Aq$ Permanent. Soluble in water, though not very readily, and the solution is not changed by long-continued ebullition. Soluble in alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. pp. 149, 146.)

b An isomeric salt corresponding to the "smouldering baryta salt" of Faraday, is readily soluble in alcohol, and is not decomposed by boiling with concentrated potash solution, from which it crystallizes out unchanged on cooling.

SulphoNaphthalate of Silver. $C_{20}\,H_7\,Ag\,S_2\,O_6$ Permanent. Soluble in water, the solution undergoing decomposition on being boiled. (Faraday, *Phil. Trans.*, 1826, **116**. 155.) Soluble in 9.7 pts. of water at 20°, or 100 pts. of water at 20° dissolve about 10.3 pts. of it. (Regnault.) The aqueous solution deposits, by prolonged boiling, a black insoluble mass. (Faraday, *loc. cit.*) Does *not* decompose, even after several hours' boiling. (Regnault.)

SulphoNaphthalate of Soda. Permanent. Soluble in water, and alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. 149.)

SulphoNaphthalate of Strontia. Permanent. Soluble in water, and alcohol. (Faraday, *Phil. Trans.*, 1826, **116**. 153.)

SulphoNaphthalate of Zinc. Permanent. Moderately soluble in hot water, crystallizing out as the solution cools. (Faraday, *Phil. Trans.*, 1826, **116**. 154.)

***Bi*SulphoNaphthalic Acid.** (*ThioNaphthalinic Acid. ThioNaphthic Acid. HypoSulphoNapthic Acid.*) $C_{20}\,H_8\,S_4\,O_{12} = C_{20}\,H_8,\ 4\,S\,O_3$ Deliquescent. Very easily soluble in water, and alcohol.

Its salts are readily soluble in water; but, generally speaking, are less soluble in alcohol than the sulphonaphthalates.

***Bi*SulphoNaphthalate of Ammonia.** Soluble in water.

***Bi*SulphoNaphthalate of Baryta.** $C_{20}\,H_6\,Ba_2\,S_4\,O_{12}$ Very slowly soluble in water, even when this is boiling, but the solution may be evaporated down to a considerable extent before yielding any deposit. Very slightly soluble in alcohol, which also precipitates it from the aqueous solution.

***Bi*SulphoNaphthalate of Lead.** $C_{20}\,H_6\,Pb_2\,S_4\,O_{12} + 4\,Aq$ Readily soluble in water. Almost insoluble in alcohol, which precipitates it from the aqueous solution. (Berzelius.)

***Bi*SulphoNaphthalate of Potash.** Readily soluble in water. Sparingly soluble in alcohol.

***Bi*SulphoNaphthalate of Soda.** Soluble in water. Tolerably soluble in alcohol.

SulphoNaphthalid. $C_{24}\,H_{10}\,S\,O_2$ Insoluble in water, concentrated nitric acid, or solution of caustic potash. Very slightly, if at all, soluble in cold, slightly soluble in boiling absolute alcohol. Very slightly soluble in ether. (Berzelius.)

SulphoNaphthalin. $C_{40}\,H_{14}\,S_2\,O_4 = \left\{\begin{matrix} C_{20}\,H_7\,S_2\,O_4 \\ C_{20}\,H_7 \end{matrix}\right.$ Insoluble in water. Scarcely at all soluble in cold, somewhat more soluble in hot spirit. Decomposed by fuming nitric acid. (Gericke, *Ann. Ch. u. Pharm.*, **100**. 216.) Boiling water dissolves only a trace of it, and becomes opaline on cooling. Soluble in cold alcohol, especially in anhydrous alcohol. (Berzelius.)

SulphoNaphthalidamic Acid. *Vid.* Naphthionic Acid.

SulphoNaphthanic Acid. *Vid.* SulphoNaphthalic Acid.

SulphoNaphthylamic Acid. *Vid.* Naphthionic Acid.

SulphoNarcotin. (*SulphoNarcotid.*) $C_{92}\,H_{48}\,N_2\,S_2\,O_{32} = N_2\left\{\begin{matrix} S_2\,O_4{''} \\ (C_{26}\,H_{15}\,O_6)_2 \\ (C_{20}\,H_9\,O_8)_2 \end{matrix}\right.$ Insoluble in cold, soluble in boiling water. Soluble in alcohol, and in an aqueous solution of caustic potash. Insoluble in ammonia-water. (Laurent & Gerhardt, *Ann. Ch. et Phys.*, (3.) **24**. 114.)

SulphoNitrite of Potassium. $K\,S,\,N\,S_3$ Soluble in water, and alcohol; but these solutions soon undergo decomposition. (Berzelius, *Lehrb.*, **3**. 198.)

SulphoNitroNaphthalic Acid. *Vid.* NitroSulphoNaphthalic Acid.

SulphoParaBenzolic Acid. $C_{12}\,H_6,\ 2\,S\,O_3$ Soluble in water.

SulphoParaBenzolate of Ammonia. Very soluble in water, and alcohol. Insoluble, or nearly insoluble, in ether. (Church, *Phil. Mag.*, (4.) **14**. 417.)

SulphoParaBenzolate of Baryta. $C_{12}\,H_5\,Ba,\ 2\,S\,O_3$ Exceedingly soluble in water. Very sparingly soluble in absolute alcohol. Almost insoluble in anhydrous ether.

SulphoParaBenzolate of Copper. Exceedingly soluble in water.

$C_{12}H_5Cu, 2SO_3$

SulphoPerChloride of Phosphorus (of Gladstone). Immediately decomposed by water. Also decomposed by alcohol, ether, and oil of turpentine. Miscible with bisulphide of carbon. (Gladstone, *J. Ch. Soc.*, **3.** 7.)

(Chloride of Phosphorus & of Sulphur.)

PCl_4S_4

SulphoPhenanilid. Very sparingly soluble in water. Easily soluble in alcohol and ether. (Biffi, *Ann. Ch. u. Pharm.*, **91.** 107.) Sparingly soluble in water. Easily soluble in alcohol, and ether. (Gericke, *Ann. Ch. u. Pharm.*, **100.** 217.)

(SulphoPhenylAnilide. Phenyl SulphoPhenylamid. Isomeric with AmidoSulphoBenzid.)

$$C_{24}H_{11}NS_2O_4 = N\left\{\begin{matrix}C_{12}H_5S_2O_4\\C_{12}H_5\\H\end{matrix}\right.$$

SulphoPhenic Acid. *Vid.* PhenylSulphuric Acid.

SulphoPhenoylamid. Difficultly soluble in cold, easily soluble in boiling water.

$$C_{12}H_5NS_2O_2 = N\left\{\begin{matrix}C_{12}H_4S_2O_2''\\H\end{matrix}\right.$$

SulphoPhenoylbiamid. Very soluble in boiling, very sparingly soluble in cold water. Soluble in ammonia-water, and in solutions of the fixed alkalies, forming salts which are very soluble in water. But its baryta and silver salts are scarcely at all soluble in water. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **53.** 311.)

$$C_{12}H_8N_2S_2O_2 = N_2\left\{\begin{matrix}C_{12}H_4S_2O_2''\\H_4\end{matrix}\right.$$

SulphoPhenylamid. Insoluble in water. Readily soluble in alcohol. Soluble in boiling ammonia-water. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 143.)

(PhenylSulphimid.)

$$C_{12}H_7NS_2O_4 = N\left\{\begin{matrix}C_{12}H_5S_2O_4\\H_2\end{matrix}\right.$$

SulphoPhenylamid with Silver. Ppt.

$$N\left\{\begin{matrix}C_{12}H_5S_2O_4\\H\\Ag\end{matrix}\right.$$

***Di*SulphoPhenylamid.** Soluble in ether.

$$C_{24}H_{11}NS_4O_8 = N\left\{\begin{matrix}(C_{12}H_5S_2O_4)_2\\H\end{matrix}\right.$$

SulphoPhenylAnilid. *Vid.* SulphoPhenAnilid.

SulphoPhenylBenzamic Acid. *Vid.* BenzoylSulphoPhenylamic acid.

SulphoPhenylBenzamid. *Vid.* BenzoylSulphoPhenylamid.

SulphoPhenylBenzoylAcetamid. Soluble in boiling ether. (Gerhardt & Chiozza.)

(BenzoylAcetylSulphoPhenylamid. BenzAcetoSulphoPhenamid.)

$$C_{30}H_{13}NS_2O_8 = N\left\{\begin{matrix}C_{14}H_5O_2\\C_{12}H_5S_2O_4\\C_4H_3O_2\end{matrix}\right.$$

SulphoPhenylBenzoylamic Acid. *Vid.* BenzoylSulphoPhemylamic Acid.

SulphoPhenylBenzoylamid. *Vid.* BenzoylSulphoPhenylamid.

SulphoPhenylBenzoylCuminamid. *Vid.* CumylBenzoylSulphoPhenylamid.

SulphoPhenylCuminamid. *Vid.* CumylSulphoPhenylamid.

SulphoPhenylicAcid. *Vid.* PhenylSulphurous Acid.

Sulpho*tri*PhenylPhosphamid.

$$N_3\left\{\begin{matrix}PS_2\\(C_{12}H_5)_3\\H_3\end{matrix}\right.$$

SulphoPhenylSuccinamicAcid. Soluble, with decomposition in water.

$$C_{20}H_{11}NS_2O_{10} = N\left\{\begin{matrix}C_8H_4O_4''\\C_{12}H_5S_2O_4\\H\end{matrix}\right. .O, HO$$

SulphoPhenylSuccinamate of Ammonia. Very soluble in water. Soluble in alcohol.

$C_{20}H_{10}(NH_4)NS_2O_{10}$

SulphoPhenylSuccinamate of Silver. Ppt. (Gerhardt & Chiozza, *Ann. Ch. et Phys.*, (3.) **46.** 159.)

$C_{20}H_{10}AgNS_2O_{10}$

SulphoPhenylSuccinamid. *Vid.* SuccinylSulphoPhenylamid.

SulphoPhloretic Acid. Very readily soluble in water, and alcohol. (Hlasiwetz.)

(PhloretinSulphuricAcid.)

$C_{18}H_{10}S_2O_{12} = C_{18}H_8O_4, 2HO, 2SO_3$

SulphoPhloretate of Baryta.

I.) *normal.* Soluble in water. Insoluble in alcohol or ether.

$C_{18}H_8Ba_2S_2O_{12} + 6Aq$

SulphoPhloretate of Lime. Soluble in water.

$C_{18}H_8Ca_2S_2O_{12}$

SulphoPhloretate of Magnesia. Soluble in water.

$C_{18}H_8Mg_2S_2O_{12}$

SulphoPhloretate of Soda. Easily soluble in water. Insoluble in alcohol or ether.

$C_{18}H_8Na_2S_2O_{12}$

SulphoPhœnicic Acid. Soluble in water, and alcohol. (Crum.) Insoluble in several saline solutions, as chloride of ammonium, or acetate of potash, and in alkaline solutions. Readily soluble in strong sulphuric acid, especially in the fuming acid. The sulpho-phœnicates are very sparingly soluble in water, but are more readily soluble in alcohol. (Crum; Berzelius.)

(Indigo Purple. Phœnicine. SulphoPurpuric Acid.)

$$C_{32}H_{10}N_2S_2O_{10} = N_2\left\{\begin{matrix}S_2O_4''\\(C_{16}H_4O_2'')_2\\H\end{matrix}\right. .O, HO$$

SulphoPhœnicate of Alumina. A solution of alum precipitates the acid from its solution in 8000 pts. of water. (Crum.)

SulphoPhœnicate of Copper. A solution of sulphate of copper precipitates the acid from its solution in 2000 pts. of water. (Crum.)

SulphoPhœnicate *of protoxide* of Iron. A solution of protosulphate of iron precipitates the acid from its solution in 3000 pts. of water. (Crum.)

SulphoPhœnicate of Lime. A solution of chloride of calcium precipitates the acid from its solution in 8000 pts. of water. (Crum.) Sparingly soluble in boiling alcohol. (Berzelius.)

SulphoPhœnicate of Magnesia. A solution of sulphate of magnesia precipitates the acid from its solution in 2000 pts. of water. (Crum.)

SulphoPhœnicate of Potash. Soluble in 100 pts. of water. Insoluble, or but sparingly soluble, in alcohol, or in an aqueous solution of acetate of potash.

$C_{32}H_9KN_2S_2O_{10} + 2Aq$

SulphoPhœnicate of Soda. A solution of chloride of sodium precipitates the acid from its solution in 60 pts. of water. (Crum.)

SulphoPhœnicate of Zinc. A solution of sulphate of zinc precipitates the acid from its solution in 2000 pts. of water. (Crum.)

Sulpho*tri*Phosphamid. Decomposed at once by hot water, but somewhat more slowly by cold water. Partially decomposed by alcohol. (Schiff.)
$N_3\left\{\begin{matrix}PS_2{}'''\\H_6\end{matrix}\right.$

SulphoPhosphAnilid.
(SulphoPhosphoryltriPhenylteramid.
$C_{36}H_{18}N_3PS_2 = N_3\left\{\begin{matrix}PS_2{}'''\\(C_{12}H_5)_3\\H_3\end{matrix}\right.$

"SulphoPhosphoric Acid"(of Berzelius). *Vid.* *Quinqui*Sulphide of Phosphorus.

"SulphoPhosphate of *X*."
"SulphoPhosphite of *X*." (of Berzelius). *Vid.* Sulphide of Phosphorus & of *X*.

SulphoPhosphoric Acid (of Wurtz). Soluble in water; but the solution is readily decomposed, especially on boiling. (A. Wurtz, *Ann. Ch. et Phys.*, (3.) **20.** 473.)
(SulphOxyPhosphoric Acid.)
PO_3S_2

SulphoPhosphate of Baryta. Insoluble in water. (Wurtz.)
$3\,BaO, PO_3S_2$

SulphoPhosphate of Cobalt. Insoluble in water; partially decomposed when boiled with water. (Wurtz, *loc. cit.*)

SulphoPhosphate of Copper. Insoluble in water. Decomposes very readily. (Wurtz, *loc. cit.*)

SulphoPhosphate of Ethyl. *Vid.* Ethyl-SulphoPhosphoric Acid.

SulphoPhosphate *of sesquioxide* of Iron. Insoluble in water. (Wurtz, *loc. cit.*)

SulphoPhosphate of Lead. Insoluble in water. Easily decomposed. (Wurtz, *loc. cit.*)
$3\,PbO, PO_3S_2$

SulphoPhosphate of Lime. Insoluble in water. (Wurtz, *loc. cit.*)

SulphoPhosphate of Nickel. Insoluble in water; partially decomposed when boiled with water. (Wurtz, *loc. cit.*)

SulphoPhosphate of Potash. Very soluble in water. (Wurtz, *loc. cit.*, p. 476.)
$3\,KO, PO_3S_2$

SulphoPhosphate of Soda. Effloresces in dry air. Sparingly soluble in cold, very soluble in boiling water. Insoluble in alcohol. (Wurtz, *loc. cit.*, p. 474.)
$3\,NaO, PO_3S_2 + 24\,Aq$

SulphoPhosphate of Strontia. Insoluble in water. (Wurtz, *loc. cit.*)

SulphoPhosphorous Acid. *Vid.* *ter*Sulphide of Phosphorus.

SulphoPhosphoVinic Acid. *Vid.* Ethyl-SulphoPhosphoric Acid.

SulphoOpianic Acid. Insoluble in water. Soluble in alcohol, and in alkaline solutions. (Wœhler.)
$C_{20}H_{10}S_2O_8 = C_{20}H_9S_2O_7, HO$

SulphOpianate of Ammonia. Soluble in water, or at least in ammonia-water.

SulphOpianate of Lead. Ppt.

SulphOpianate of Potash. Soluble in water, or in a solution of caustic potash.

SulphOpianate of Silver. Ppt.

SulphOpianate of Soda. Resembles the potash salt.

SulphoPlatinic Acid. *Vid.* *bi*Sulphide of Platinum.

SulphoPlatinate of Ammonium.

SulphoPlatinate of Sodium. Soluble in water.

*Bi*SulphoPropiolicAcid.
$C_6H_8, 4\,SO_3$

*Bi*SulphoPropiolate of Baryta. Very soluble in water. Soluble in alcohol. (Buckton & Hofmann, *J. Ch. Soc.*, **9.** 253.)
$C_6H_6Ba_2, 4\,SO_3$

SulphoPropionic Acid.
(PropionSulphuric Acid.)
$C_6H_6S_2O_{10} = C_6H_4O_2, 2\,HO, 2\,SO_3$

SulphoPropionate of Ammonia. Soluble in water, and dilute alcohol. From these solutions it is precipitated by absolute alcohol.

SulphoPropionate of Baryta. Tolerably soluble in hot water. (Buckton & Hofmann, *J. Ch. Soc.*, **9.**)
$C_6H_4Ba_2S_2O_{10}$

SulphoPropylic Acid.
(PropylSulphuricAcid. TritylSulphuric Acid. Sulphate of Propyl.)
$C_6H_8S_2O_8 = C_6H_7O, HO, 2\,SO_3$

SulphoPropylate of Baryta. Soluble in water; the solution is decomposed to a slight extent on evaporation. (Berthelot & De Luca, *Ann. Ch. et Phys.*, (3.) **43.** 402.)
$C_6H_7BaS_2O_8 + 6\,Aq$ & $+ 2\,Aq$

SulphoPropylate of Lime. Deliquescent.

SulphoPropylate of Potash. Very soluble in water, the solution undergoing decomposition when boiled. Soluble in boiling absolute alcohol. (Chancel.)
$C_6H_7KS_2O_8$

SulphoPurpuric Acid. [The name has also been incorrectly applied to SulphoPhœnicic Acid, q. v.] Soluble in water. Insoluble, or very sparingly soluble, in alcohol.

SulphoPurpurate of Lead.

I.) Slightly soluble in water. Insoluble in alcohol.

II.) *basic.* Insoluble in water.

SulphoPurpurate of Potash. Soluble in water. (Berzelius.)

SulphoRetinylate of Baryta. Sparingly soluble in water, being much less soluble in water than the cumenylsulphite of baryta. Difficultly soluble in absolute alcohol. (Gerhardt & Cahours.)
$C_{18}H_{11}BaS_2O_6$

SulphoRhodiate of Potassium. Soluble in an aqueous solution of sulphide of potassium. (Berzelius.)

SulphoRufic Acid. Soluble in water. Insoluble in alcohol. (Berzelius.)

SulphoRufate of Lead. Easily soluble in water, and alcohol.

SulphoSaccharic Acid. Soluble in water. Most of its salts are soluble in water.

SulphoSaccharate of Baryta. Easily soluble in water.

SulphoSaccharate of Lead. Insoluble in water. (Peligot.)
$4\,PbO, C_{24}H_{20}O_{20}, SO_3$

SulphoSalicol. *Vid.* SulphoSalicylous Acid.

SulphoSalicylic Acid. Deliquescent. Soluble in all proportions in water, alcohol, and ether. (Mendius.)
$C_{14}H_6S_2O_{12} = C_{14}H_4O_4, 2\,HO, 2\,SO_3$

Most of its salts are soluble in water, but insoluble in alcohol or ether.

SulphoSalicylate of Ammonia. Soluble in water, the solution undergoing decomposition when evaporated. (Mendius, *Ann. Ch. u. Pharm.*, **103.** 39.)

SulphoSalicylate of Baryta.

I.) *normal.* Sparingly soluble in cold, readily soluble in hot water. Insoluble in alcohol or ether.
$C_{14}H_4Ba_2S_2O_{12} + 6\,Aq$

II.) *acid.* Permanent. Readily soluble in water. Insoluble in alcohol or ether.
$C_{14}H_5BaS_2O_{12} + 4\,Aq$

SulphoSalicylate of Copper.

I.) *normal.* Permanent. Very soluble in water. Sparingly soluble in hot, less soluble in cold alcohol.
$C_{14}H_4Cu_2S_2O_{12}$

II.) *basic.* Easily soluble in water. Insoluble in alcohol.
$C_{14}H_4Cu_2S_2O_{12}, 2\,CuO + 4\,Aq$

SulphoSalicylate of Ethyl. Insoluble in water. Readily soluble in alcohol, and ether. (Mendius.)
$C_{14}H_4(C_4H_5)_2S_2O_{12}$

SulphoSalicylate of Lead. Sparingly soluble in cold water. Insoluble in alcohol.
$C_{14}H_4Pb_2S_2O_{12}$

SulphoSalicylate of Lime. Soluble in water. Insoluble in alcohol or ether.
$C_{14}H_4Ca_2S_2O_{12} + 2\,Aq$

SulphoSalicylate of Magnesia. Very soluble in water. Insoluble in alcohol.
$C_{14}H_4Mg_2S_2O_{12} + 6\,Aq$

SulphoSalicylate of Potash.

I.) *normal.* Permanent. Very soluble in water. Very sparingly soluble in alcohol, and ether.
$C_{14}H_4K_2S_2O_{12} + 4\,Aq$

II.) *acid.* Very readily soluble in water. Insoluble in alcohol.
$C_{14}H_5KS_2O_{12} + 4\,Aq$

III.) *sesquibasic.* Easily soluble in water. Insoluble in alcohol.
$C_{14}H_4K_2S_2O_{12}; C_{14}H_5KS_2O_{12} + 2\,Aq$

SulphoSalicylate of Potash & of Soda. Soluble in water. Insoluble in alcohol or ether.
$C_{14}H_4KNaS_2O_{12} + 8\,Aq$

SulphoSalicylate of Silver. Sparingly soluble in cold, readily soluble in hot water, but the solution is decomposed by long-continued boiling. Insoluble in alcohol.
$C_{14}H_4Ag_2S_2O_{12} + 2\,Aq$

SulphoSalicylate of Soda.

I.) *normal.* Very soluble in water. Insoluble in alcohol or ether.
$C_{14}H_4Na_2S_2O_{12} + 6\,Aq$

II.) *acid.* Permanent. Easily soluble in water. Sparingly soluble in alcohol.
$C_{14}H_5NaS_2O_{12} + 4\,Aq$

SulphoSalicylate of Zinc. Readily soluble in water. Insoluble in alcohol.
$C_{14}H_4Zn_2S_2O_{12} + 6\,Aq$

SulphoSalicylous Acid. Insoluble, or very sparingly soluble, in alcohol. Soluble, with combination, in alkaline solutions. (Cahours.)
(SulphoSalicol. ThioSalicol. Hydride of SulphoSalicyl.)
$C_{14}H_6S_2O_2$

SulphoSinapic Acid. *Vid.* AllylSulphoCarbamic Acid.

SulphoSinapisin. *Vid.* SulphoCyanhydrate of Sinapin.

SulphoMethylic Acid. *Vid.* MethylSulphurous Acid.

SulphoStannic Acid. *Vid. bi*Sulphide of Tin. The sulphostannates of the alkalies and alkaline earths are soluble in water. (Berzelius.)

SulphoStannate of Ammonium.

SulphoStannate of Barium. Soluble in water. (Berzelius.)

SulphoStannate of Calcium.

SulphoStannate of Copper & of Iron. Soluble, with decomposition, in nitric acid.
$2\,Cu_2S, SnS_2; 2\,FeS, SnS_2$

SulphoStannate of Potassium. Very easily soluble in water, from which alcohol throws down a more concentrated solution. (Kuehn.)
$KS, SnS_2 \& + 10\,Aq$

SulphoStannate of Sodium.

I.) Permanent. Soluble in water. (Hœring.)
$NaS, SnS_2 + 7\,Aq$

II.) Soluble in water. (Kuehn.)
$2\,NaS, SnS_2 + 12 @ 15\,Aq$

SulphoStannate of Strontium.

SulphoSuccinanil. *Vid.* SuccinylSulphoPhenylamid.

SulphoSuccinanilic Acid. *Vid.* SulphoPhenylSuccinamic Acid.

SulphoSuccinic Acid. Very hygroscopic. Readily soluble in water, alcohol, and ether. (Fehling.) Most of its salts are easily soluble in water.
$C_8H_6S_2O_{14} + 2\,Aq = C_8H_3O_5, 3\,HO, 2\,SO_3 + 2\,Aq$

SulphoSuccinate of Ammonia.
$C_8H_3(NH_4)_3S_2O_{14} + 2\,Aq$

SulphoSuccinate of Baryta. Whilst still moist it is readily soluble in chlorhydric and nitric acids, and sparingly in hot acetic acid; but after having become dry it is much less soluble in chlorhydric, and almost insoluble in acetic acid. Soluble in sulphosuccinic acid. (Fehling.)
$C_8H_3Ba_3S_2O_{14}$

SulphoSuccinate of Cobalt. Appears to be soluble in water.

SulphoSuccinate of Copper. Appears to be soluble in water.

SulphoSuccinate *of protoxide* **of Iron.** Appears to be soluble in water.

SulphoSuccinate of Lead.

I.) *normal.* Insoluble in water. Soluble in nitric and chlorhydric acids, and in an aqueous solution of acetate of ammonia acidulated with acetic acid.
$C_8H_3Pb_3S_2O_{14} + 3\,Aq$

II.) *basic.* Tolerably soluble in chlorhydric, nitric, and sulphosuccinic acids.
$C_8H_3Pb_3S_2O_{14}, PbO$

SulphoSuccinate of Lime. Very easily soluble in water. Insoluble in alcohol. (Berzelius's *Lehrb.*, 3. 422.)
$C_8H_4Ca_2S_2O_{14}$

SulphoSuccinate of Magnesia. Extremely easily soluble in water. (*Ibid.*, p. 456.)
$C_8H_4Mg_2S_2O_{14}$

SulphoSuccinate of Manganese. Appears to be soluble in water.

SulphoSuccinate of Nickel. Appears to be soluble in water.

SulphoSuccinate of Potash.

I.) *normal.* Hygroscopic, but not deliquescent. Readily soluble in water. Almost insoluble in absolute alcohol, but very easily soluble in alcohol of 80%. (Fehling.)
$C_8H_3K_3S_2O_{14} + 5\,Aq$

II.) *di.* Permanent. Readily soluble in cold, and in almost all proportions in boiling water.
$C_8H_4K_2S_2O_{14} + 2\,Aq \& 4\,Aq$

SulphoSuccinate of Silver. Insoluble in water. Easily decomposed.
$C_8H_3Ag_3S_2O_{14}$

SulphoSuccinate of Soda.
I.) *normal.* Readily soluble in water, and spirit.

SulphoTellurous Acid. *Vid. bi*Sulphide of Tellurium. The alkaline sulpho-tellurites are readily soluble in water; less soluble in alcohol; but the solutions undergo decomposition when exposed to the air.

SulphoTellurite of Ammonium. Soluble
$3\ NH_4S, TeS_2$ in water.

SulphoTellurite of Barium. Tolerably
$3\ BaS, TeS_2$ permanent. Slowly soluble in water. (Berzelius.)

SulphoTellurite of Bismuth. Ppt.
$BiS_3, 3\ TeS_2$

SulphoTellurite of Cadmium. Ppt.
$3\ CdS, TeS_2$

SulphoTellurite of Calcium. Quickly
$3\ CaS, TeS_2$ decomposes in the air. Easily soluble in water.

SulphoTellurite of Cerium. Ppt.
$3\ CeS, TeS_2$

SulphoTellurite of Cobalt. Ppt.
$3\ CoO, TeS_2$

SulphoTellurite of Copper. Ppt.
$3\ CuS, TeS_2$

SulphoTellurite of Gold. Somewhat
AuS_3, TeS_2 soluble in water. (Berzelius.)

SulphoTellurite *of protosulphide* of Iron.
$3\ FeS, TeS_2$ Ppt.

SulphoTellurite *of bisulphide* of Iron.
Fe_2S_3, TeS_2 Ppt.

SulphoTellurite of Lead. Ppt.
$3\ PbS, TeS_2$

SulphoTellurite of Lithium. Soluble in
$3\ LiS, TeS_2$ water.

SulphoTellurite of Magnesium. Soluble,
$3\ MgS, TeS_2$ without decomposition, in water. Tolerably soluble in alcohol. (Berzelius.)

SulphoTellurite of Manganese. Ppt.
MnS, TeS_2

SulphoTellurite *of disulphide* of Mer-
$3\ Hg_2S, TeS_2$ cury. Ppt.

SulphoTellurite *of protosulphide* of Mer-
$3\ HgS, TeS_2$ cury. Ppt.

SulphoTellurite of Nickel.

SulphoTellurite of Platinum. Soluble
$3\ PtS_2, 2\ TeS_2$ in water, but after several days it separates out from the solution.

SulphoTellurite of Potassium. Deli-
$3\ KS, TeS_2$ quesces in moist air. Soluble in water, but the solution soon undergoes decomposition when exposed to the air.

SulphoTellurite of Silver. Ppt.
$3\ AgS, TeS_2$

SulphoTellurite of Sodium. Soluble in
$3\ NaS, TeS_2$ water.

SulphoTellurite of Strontium. Toler-
$3\ SrS, TeS_2$ ably permanent. Completely soluble in water.

SulphoTellurite *of protosulphide* of Tin.
$3\ SnS, TeS_2$ Ppt.

SulphoTellurite *of bisulphide* of Tin. Ppt.
$3\ SnS_2, 2\ TeS_2$

SulphoTellurite of Zinc. Ppt.
$3\ ZnS, TeS_2$

SulphoTerebic Acid.
$C_{20}H_{16}S_2O_6$?

SulphoTerebate of Baryta. Soluble in
$C_{20}H_{15}BaS_2O_6$ water. (Gerhardt.)

SulphoThymic Acid. *Vid.* ThymylSulphuric Acid.

SulphoToluenic Acid. *Vid.* ToluenylSulphurous Acid.

SulphoToluic Acid. *Vid.* ToluenylSulphurous Acid.

SulphoToluol. Insoluble in water. (De-
(*Thio Toluol.*) ville.)
$C_{14}H_7SO_2$

SulphoTungstic Acid. Sparingly soluble
(*Ter Sulphide of Tungsten.*) in water, more readily
WS_3 in hot than in cold. It is precipitated from the aqueous solution on the addition of chloride of ammonium, or of acids, though not absolutely insoluble in acidulated water. Soluble, especially when recently precipitated and still moist, in aqueous solutions of caustic potash, carbonate of potash, the alkaline sulphides, and in ammonia-water. The alkaline sulphotungstates are soluble in water, but the solutions gradually undergo decomposition when exposed to the air.

SulphoTungstate of Ammonium. Much
NH_4S, WS_3 more readily soluble in pure water than in dilute saline solutions. The aqueous solution is slowly decomposed when exposed to the air. (Berzelius.)

SulphoTungstate of Ammonium with
$NH_4S, WS_3; NH_4O, WO_3$ Tungstate of Ammonia. Soluble in water, and alcohol. (Berzelius, *Lehrb.*, 3. 338.)

SulphoTungstate of Barium. Soluble in
BaS, WS_3 an aqueous solution of sulphide of barium.

SulphoTungstate of Bismuth.
$BiS_3, 3\ WS_3$

SulphoTungstate of Cadmium. Ppt.
CdS, WS_3

SulphoTungstate of Calcium. Easily
CaS, WS_3 soluble in water; also somewhat soluble in alcohol. (Berzelius.)

SulphoTungstate of Cerium. Ppt.
CeS, WS_3

SulphoTungstate of Chromium. Soluble
Cr_2S_3, WS_3 in water. (Berzelius, *Lehrb.*)

SulphoTungstate of Cobalt. Sparingly
CoS, WS_3 soluble in water. (Berzelius.)

SulphoTungstate of Copper. Ppt.
CuS, WS_3

SulphoTungstate of Glucinum. Apparently soluble in water. (Berzelius, *Lehrb.*)

SulphoTungstate of Gold. Soluble in
$AuS_3, 3\ WS_3$ water, but a precipitate forms in this solution after it has stood for a few days. (Berzelius, *Lehrb.*)

SulphoTungstate *of protosulphide* of Iron.
FeS, WS_3 Soluble in water. (Berzelius, *Lehrb.*)

SulphoTungstate *of sesquisulphide* of Iron.
$Fe_2S_3, 3\ WS_3$ Ppt.

SulphoTungstate of Lead. Ppt.
PbS, WS_3

SulphoTungstate of Magnesium.
I.) *normal.* Readily soluble in water, and al-
MgS, WS_3 cohol. (Berzelius.)
II.) *acid.* Insoluble in water.
III.) *basic.* Ppt.

SulphoTungstate of Manganese. Soluble
MnS, WS_3 in water. (Berzelius.)

SulphoTungstate *of disulphide* of Mer-
Hg_2S, WS_3 cury. Ppt.

SulphoTungstate *of protosulphide* of Mercury. HgS, WS_3 Ppt.

SulphoTungstate of Nickel. NiS, WS_3 Soluble in water.

SulphoTungstate *of bisulphide* of Platinum. $PtS_2, 2WS_3$ The aqueous solution remains clear for a long time, but finally deposits a precipitate.

SulphoTungstate of Potassium.

I.) Easily soluble in water. Sparingly soluble KS, WS_3 in alcohol, by which it is precipitated from the aqueous solution.

II.) Soluble in water. $KS, 2WS_3$

SulphoTungstate of Potassium with Tungstate of Potash. $KS, WS_3; KO, WO_3 + 4Aq$ Soluble in water, and alcohol. (Berzelius, *Lehrb.*)

SulphoTungstate of Silver. AgS, WS_3

SulphoTungstate of Sodium. NaS, WS_3 Very soluble in water; less soluble in alcohol, although still very soluble therein, especially if it contains sulphide of sodium.

SulphoTungstate of Strontium. SrS, WS_3 Soluble in water and in an aqueous solution of sulphide of strontium.

SulphoTungstate *of protosulphide* of Tin. SnS, WS_3 Ppt.

SulphoTungstate *of bisulphide* of Tin. $SnS_2, 2WS_3$ Ppt.

SulphoTungstate of Vanadium. Soluble in water.

SulphoTungstate of Zinc. ZnS, WS_3 Soluble in water, with subsequent precipitation.

SulphoValerolic Acid. Not isolated.

SulphoValerolate of Lead. Soluble in water. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **7.** 278.)

SulphoVanadic Acid. *Vid. ter*Sulphide of Vanadium. The sulphovanadiates of the alkalies are soluble, those of the alkaline earths difficultly soluble, and those of the metals proper insoluble in water.

SulphoVanadiate of Ammonium.

SulphoVanadiate of Barium. Slightly soluble in water.

SulphoVanadiate of Calcium. Slightly soluble in water.

SulphoVanadiate of Potassium. KS, VS_3 Soluble in water. Insoluble in alcohol.

SulphoVanadiate of Strontium. Slightly soluble in water.

SulphoVanadious Acid. *Vid. bi*Sulphide of Vanadium. The alkaline sulphovanadites are soluble in water. (Berzelius.)

SulphoVanadite of Ammonium. Soluble in water.

SulphoVanadite of Potassium. KS, VS_2 Soluble in water.

SulphoVinic Acid. *Vid.* EthylSulphuric Acid.

SulphoViridic Acid. Very readily soluble in water. Slowly, but completely, soluble in strong alcohol. (Berzelius.)

SulphoViridate of Lead. Somewhat soluble in water. (Berzelius.)

SulphoXanthic Acid. *Vid.* SulphoCarbonate of Ethyl (No. II.).

SulphOxyArsenic Acid. AsO_3S_2 Sparingly soluble in water.

SulphOxyArseniate of Potash. $KO, AsO_3S_2 + 2Aq$ Permanent. Sparingly soluble in water. The aqueous solution soon undergoes decomposition, especially when boiled, unless an excess of alkali is present, in which event the decomposition is retarded. (Bouquet & Cloez, *Ann. Ch. et Phys.*, (3.) **13.** 54.)

SulphOxylolic Acid. *Vid.* XylenylSulphurous Acid.

SulphOxyPhosphoric Acid. *Vid.* SulphoPhosphoric Acid.

Sulphur. S The ordinary modification of sulphur is insoluble in water; slightly soluble in alcohol, ether, benzin, oil of turpentine, and in general in the fatty and essential oils, especially when these liquids are warm. Much more soluble in bisulphide of carbon, from which it is precipitated on the addition of ether, alcohol, or a hot solution of caustic potash.

100 pts. of	Saturated at °C.	Dissolve pts. of flowers of sulphur.
Ether (hot)		0.54
" (cold)		0.188
Bisulphide of carbon (hot)		73.46
Bisulphide of carbon	16°	38.70
Rectified coal-tar naphtha (boiling at 98 @ 100°)	98 @ 100°	26.98
" "	16°	1.51
Benzin (boiling at 86°)	86°	17.04
" "	75°	7.91
" "	16°	1.79
A mixture of equal pts. of benzin and oil of turpentine	boiling	16.41
" "	16°	2.19
Oil of turpentine	150°	16.16
" "	75°	6.24
" "	16°	1.37
A mixture of 4 vols. oil of turpentine and 1 vol. benzin	boiling	14.26
" "	16°	2.59
Naphtha (from Valtravers)	boiling	10.56
" "	16°	2.77
Absolute alcohol	boiling	0.42
" " . . .	16° . . .	0.12

(Payen, *C. R.*, 1852, **34.** pp. 509, 456.)

Soluble in 20 pts. of hot nearly absolute alcohol; less easily soluble in weaker alcohol. (Laurogais; Favre.) Soluble in 600 pts. of boiling alcohol of 40° B. (Chevallier, *J. Ch. Méd.*, **2.** 587 [P.]); in 500 pts. of alcohol (Meissner, in his *Neues System der Chem. 2te Auf.*, **3.** 111 [P.]; in 200 pts. of alcohol (Pelouze & Fremy); in 1926.7 pts. of absolute alcohol at 15°, *i. e.* 100 pts. of absolute alcohol at 15° dissolve 0.0519 pt. of sulphur. (Pohl, *Wien. Akad. Bericht*, **6.** 600.)

Quickly soluble in 12.5 pts. of ether at the ordinary temperature. (Favre.) Acetic ether dissolves 6% of it. (Favre.)

Soluble in 12 pts. of hot rock-oil (naphtha) from Amiano, but nearly insoluble in cold naphtha. (Saussure.) 100 pts. of nicotin at 100° dissolve 10.58 pts. of sulphur, this separates out again, for the most part, as the solution cools. Also soluble in warm anilin. (Barral, *Ann. Ch. et Phys.*, (3.) **20.** 352.) Abundantly soluble in hot, less soluble in cold anilin. (Fritzche.) Very largely soluble in anilin, and quinolein (as in all the essential oils), especially when these are warm. From the hot solution it separates out on cooling. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** pp. 143, 169.) Soluble in 2.6 pts. of boiling, sparingly soluble in cold creosote. (Reichenbach.)

Soluble, by digestion, in about 2 pts. of oil of turpentine. More soluble in hot than in cold oil of turpentine.

When oil of turpentine is heated with sulphur to 150° decomposition commences. (Payen, *C. R.*, **34.** 508.) Soluble in hot oil of copaiba, from which it crystallizes on cooling. (Gerber.) Soluble in oil of mandarin. (Luca.) Abundantly soluble in hot oil of caraway, being deposited again on cooling.

Sulphur is soluble to a notable extent in the numerous liquids comprising the hydrogenized and oxygenated essential oils, the alcohols, ethers, fatty oils, and pyrogenous oils. (Payen, *C. R.*, 1852, **34.** 509.)

Somewhat soluble in hot, less soluble in cold wood-spirit. (Payen, *C. R.*, 1852, **34.** 509.) Sparingly soluble in wood-spirit, in lignone, from which it is precipitated on the addition of water (L. Gmelin), in bromoform; in cold benzin, but largely soluble in boiling benzin (Mansfield, *J. Ch. Soc.*, **1.** 262), in mercuric methyl, in nitrate of ethyl, which, when of 0.909 sp. gr., dissolves $\frac{1}{20}$ pt. of it; from this solution it is not precipitated by water. (Favre.) Very slightly soluble in cold acetone. (Chenevix, *Ann. de Chim.*, 1809, **69.** 50.)

Soluble in naphtha, in aldehyde (Liebig), in iodal, in bromal (Lœwig), in chloroform, in warm choral (Liebig), in an aqueous solution of sinkalin (Babo), in chloride of ethyl, in warm chloride of benzoyl, in bichloride of tin, in warm liquid sulphydric acid (Niemann), in warm sulphide of phosphorus, in sulphide of bromine, in bromine, in terchloride of nitrogen, in an aqueous solution of sulphide of barium (Dumas, *Tr.*), in an alcoholic solution of quinquisulphide of potassium, but is reprecipitated on the addition of water to the saturated solution. (Berzelius's *Lehrb.*, **2.** 82.) Soluble in aqueous solutions of the alkaline sulphites, especially if these are hot. (Bolley, *Ann. Ch. u. Pharm.*, 1842, **44.** 357.) Slightly soluble in a strong boiling aqueous solution of sulphocyanhydric acid, from which it separates again, for the most part, on cooling. (Porrett, *Phil. Trans.*, 1814, p. 548.) Soluble in sulphydrate of butyl (butylsulphydric acid), in warm retinole, and in alkaline leys.

Extremely soluble in coniin. (Blyth, *J. Ch. Soc.*, **1.** 350.) Very readily soluble in caprylic alcohol (hydrate of capryl). (Bouis, *Ann. Ch. et Phys.*, (3.) **44.** 103.) Readily soluble in dichloride of sulphur. Very soluble in warm sulphocyanide of allyl (essence of mustard) (Fontanelle; Dumas & Peligot), and in hot alkarsin (oxide of cacodyl). Very readily soluble in hot, less soluble in cold sulphoperchloride of phosphorus ($P\,Cl_5\,S_4$ of Gladstone). Tolerably readily soluble in warm styrol, separating out again on cooling. Readily soluble in warm, less soluble in cold toluene, and rosin-oil. (Pelletier & Walter.) Soluble in olive-oil at 115°, from which it separates out, in great part, on cooling. Also soluble in the pyrogenous oil of resin, both crude and purified, at 120°, the solution solidifying almost completely on cooling. (Payen, *C. R.*, 1852, **34.** 509.) Largely soluble in hot oil of amber (ambereupion), from which it crystallizes out on cooling. (Dœpping.) Soluble in 2 pts. of hot, slightly soluble in cold caoutchin; the hot solution deposits much of it on cooling, but still retains a larger quantity than can be taken up by cold caoutchin.

Sulphydrate of ethyl dissolves sulphur slowly, but in considerable quantity. (Zeise.) Insoluble in valerianic acid, valerate of amyl, hydride of valeryl, or hydrate of amyl (fusel-oil). (Trautwein.)

The soft elastic sulphur which is obtained when molten sulphur, the temperature of which is higher than 260°, is poured into water, sometimes contains as much as 35% of a peculiar amorphous modification of sulphur which is completely insoluble in bisulphide of carbon, either hot or cold. It dissolves, however, in absolute alcohol. When subjected to a current of aqueous vapor at 100°, or indeed to the action of simple heat at 90° or 100°, this modification is changed into ordinary sulphur, crystallizable and soluble in bisulphide of carbon. (Ch. Deville, in Pelouze & Fremy, *Tr.*) The variety of sulphur insoluble in bisulphide of carbon has also been obtained under other circumstances, viz., by the action of chlorhydric acid on metallic hyposulphites. (Fordos & Gélis.)

When heated to 350°, or till it passes from the pasty to the thin fluid state, and then slowly cooled, sulphur dissolves almost entirely in bisulphide of carbon. That which has been heated to 300°, and then quickly cooled, is only partially soluble in bisulphide of carbon, and especially that which has been cooled by pouring into cold water; over 40% of this sulphur being insoluble. From the solution in bisulphide of carbon, after rhombic crystals have separated, amorphous granules are deposited which cannot be again dissolved in the bisulphide. The rhombic crystals, however, are readily soluble in bisulphide of carbon. (Magnus, *Ann. Ch. u. Pharm.*, **101.** 61.)

Bisulphide of carbon at 12° dissolves 0.35 pt. of ordinary sulphur. Some varieties of sulphur are, however, not entirely soluble in bisulphide of carbon, thus:

Variety of sulphur.	Pts. of S dissolved by one pt. of $C\,S_2$.	At °C.	Fraction of the original weightwhich is insoluble in $C\,S_2$.
Octahedral, from Sicily	0.335	12°	0.000
Crystall. dry way, recently prepared	0.415	13°	0.029
" prep. 8 yrs.	0.333	12°	0.004
" " 9 yrs.			0.020
" " 15 yrs.			0.051
Red needles, recently prepared	0.382	12°	0.023
Soft yellow, recently prepared			0.353
" 2 years	0.316	11°	0.157
Soft red, recently prepared	0.374	11°	0.157
Soft red, prep. 5 yrs.			0.181
Flowers of sulphur	0.351	13°	0.113
" " another sample			0.234
Roll brimstone, outside			0.029
" " inside			0.073

(Ch. Deville, *Ann. Ch. et Phys.*, (3.) **47.** 99.)

All these varieties of sulphur, even the portion insoluble in bisulphide of carbon, dissolve without residue in warm absolute alcohol; crystallizing on cooling. They are less soluble in chloroform or ether than in alcohol. Readily soluble in boiling, less soluble in cold benzin. (Ch. Deville, *loc. cit.*)

The soft pasty sulphur obtained by decomposing $H S$ with $S O_2$ forms an almost clear emulsion (pseudosolution)* or incomplete solution, from which it is precipitated by various salts and other soluble substances which have no chemical affinity for it. This pseudo solution appears to depend upon a peculiar kind of diffusion, analogous to the swelling up of gelatinous, albuminous, and slimy substances, or of starch, so that an apparent solution is formed. Of the sulphur in question, 23 pts. combine with 100 pts. of water. When precipitated by the addition of saline solutions it retains, very pertinaciously, portions of the precipitant. When the pseudosolution of sulphur is exposed to the light, the sulphur is gradually converted into a pulverulent modification, and separates as such. The same thing occurs when the ps.- solution is boiled. It is precipitated by the concentrated mineral acids, without affecting its solubility at first, but it soon changes when kept in contact with them. It is precipitated by many mineral salts; especially by those of potassium; in this case its power of forming pseudo solutions is destroyed. But when thrown down by salts of soda or of ammonia, it may again be dissolved in pure water. Caustic, carbonated, and sulphuretted alkalies convert the soluble sulphur into insoluble. The pseudo solution of sulphur in water may be mixed with alcohol without change. When shaken for a long time with naphtha or oil of turpentine it is decomposed. The pseudo solution combines readily with bisulphide of carbon, and forms an emulsion which subsequently undergoes composition. The sulphur itself is only partially soluble in bisulphide of carbon. (Selmi, *J. pr. Ch.*, **57**. 49.)

Berthelot refers all the varieties of sulphur to two modifications; viz., I.) "octahedral," or, electronegative, and, II.) "amorphous," or, electropositive.

I.) *Octahedral*, or *electronegative Sulphur*. All of its varieties are soluble in bisulphide of carbon. It is scarcely acted upon by a solution of bisulphite of potash. Oxydizing bodies in contact with sulphur at the moment it is disengaged convert this to insoluble sulphur.

II.) *Amorphous*, or *electropositive Sulphur*. Insoluble in neutral solvents, viz., in water, alcohol, ether, bisulphide of carbon, &c. Soluble, with tolerable rapidity, in a solution of bisulphite of potash. By continued contact with a solution of sulphide of sodium, a portion of it is dissolved, and the remainder changed into octahedral sulphur. With solutions of caustic potash, and ammonia, similar reactions occur. Less easily oxydized by nitric acid than the other modification. Some varieties, as that contained in soft sulphur prepared by heat, are soluble, to a certain extent, in alcohol, and ether; and, by boiling, the rest of the sulphur is converted into the electronegative modification. A similar result is attained by long-continued contact with cold alcohol. According to Berthelot, the condition of the sulphur is changed before it dissolves. Solutions of the alkalies, alkaline salts, and alkaline sulphides, all change insoluble to soluble sulphur. (Berthelot, *Ann. Ch. et Phys.*, (3.) **49**. 430.)

Of the compounds of sulphur with the metals (sulphides), all those of the alkalies are soluble in water, but most of those of the heavy metals are not acted upon by water. Only the sulphides of potassium and of sodium are soluble in alcohol. Several of the alkaline sulphides are soluble in ether. (Gmelin.)

SULPHURET OF *X*. *Vid.* Sulphide of *X*.

SULPHURETTED ACETIC ACID. *Vid.* Sulphydrate of Acetyl.

SULPHURETTED HYDROGEN. *Vid.* Sulphydric Acid.

SULPHURETTED HYPOSULPHURIC ACID. *Vid.* *tri*Thionic Acid.

*Bi*SULPHURETTED HYPOSULPHURIC ACID. *Vid.* *tetra*Thionic Acid.

*Ter*SULPHURETTED HYPOSULPHURIC ACID. *Vid.* *penta*Thionic Acid.

SULPHURETTEDNITROSULPHIDE OF IRON. $Fe_2 S_3, N O_2, 4 H S$ Insoluble in water, but is decomposed thereby. Soluble in alcohol, and ether; also, with combination, in aqueous alkaline solutions. (Roussin, *Ann. Ch. et Phys.*, (3.) **52**. 295.)

*Bi*SULPHURETTEDOXIDE OF ETHYL. *Vid.* Oxide of *bi*SulphEthyl.

SULPHURETTEDSULPHUROUS ACID. *Vid.* Hyposulphurous Acid.

SULPHURIC ETHER. *Vid.* Oxide of Ethyl.

SULPHUROUS ETHER. *Vid.* Sulphite of Ethyl.

SULPHURYLAMMONIUM.
$N \left\{ \begin{matrix} H_2 \\ S_2 O_2'' \end{matrix} \right.$

SULPHURYL*bi*AMMONIUM. $N_2 \left\{ \begin{matrix} H_6 \\ S_2 O_2'' \end{matrix} \right.$ Deliqnesces, with decomposition. Easily soluble in water, without decomposition at first, but the solution soon undergoes decomposition. (H. Rose.)

SULPHYDRIC ACID. (*Hydrosulphuric Acid. Sulphuretted Hydrogen. Sulphide of Hydrogen.*) $H S$ 1 vol. of water absorbs 1.08 vol. of it at 10° (Henry, *Phil. Trans.*, 1803, p. 274 [T.]); 2.53 vols. at 18° (De Saussure, *Ann. Phil.*, **6**. 340 [T.]); 3.66 vols. at the ordinary temperature (T. Thomson, in his *System. of Chem.*, London, 1831, **1**. 275); 3 vols. at 11° (Gay-Lussac & Thénard); about 2.5 vols. of it, not 1 vol. as was previously stated. (Dalton, in his *New System*, **2**. 310; compare *Ibid.*, p. 451.)

1 vol. of water, under a pressure of $0^{m}.76$ of mercury, at °C.	Dissolves of H S gas: vols. reduced to 0 °C. & $0^{m}.76$ pressure of mercury.
0°	4.3706
1°	4.2874
2°	4.2053
3°	4.1243
4°	4.0442
5°	3.9652
6°	3.3872
7°	3.8103
8°	3.7345
9°	3.6596
10°	3.5858
11°	3.5132
12°	3.4415
13°	3.3708
14°	3.3012
15°	3.2326
16°	3.1651
17°	3.0986

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* The other varieties of pasty sulphur (prepared in various ways) do not possess this property.

1 vol. of water, under a pressure of 0m.76 of mercury, at °C.	Dissolves of H S gas: vols. reduced to 0°C. & 0m.76 pressure of mercury.
18°	3.0331
19°	2.9687
20°	2.9053
21°	2.8430
22°	2.7817
23°	2.7215
24°	2.6623

(Schœnfeld, *Ann. Ch. u. Pharm.*, **95.** 1; and Bunsen's *Gasometry*, pp. 289, 128, 146.)

Less soluble in aqueous solutions of chloride of sodium or chloride of calcium than in pure water. Sulphuretted hydrogen gas seems to be out of proportion less soluble than carbonic acid gas in water at high temperatures, as when heated in sealed tubes. (De Senarmont, *Ann. Ch. et Phys.*, (3.) **32.** 169.)

At 18°C. and the ordinary pressure, 100 vols. of	Absorb vols. of H S.
Water, free from air	253
Alcohol, of 0.84 sp. gr.	606

(Th. de Saussure, *Gilbert's Ann. der Phys.*, 1814, **47.** 167.)

1 vol. of alcohol, under a pressure of 0m.76 of mercury, at °C.	Dissolves of H S gas: vols., reduced to 0°C. and 0m.76 pressure of mercury.
0°	17.891
1°	17.242
2°	16.606
3°	15.983
4°	15.373
5°	14.776
6°	14.193
7°	13.623
8°	13.066
9°	12.523
10°	11.992
11°	11.475
12°	10.971
13°	10.480
14°	10.003
15°	9.539
16°	9.088
17°	8.650
18°	8.225
19°	7.814
20°	7.415
21°	7.030
22°	6.659
23°	6.300
24°	5.955

(Bunsen's *Gasometry*, pp. 289, 128, 160.)

Soluble in acetate of methyl. (Marchand.) Soluble in ether. (Higgins.) Insoluble in caoutchin.

Difficultly absorbed by concentrated sulphuric acid, with separation of sulphur and evolution of sulphurous acid. Instantly decomposed by fuming nitric acid. At the temperature of —18° (= 0°F.) the hydrate of sulphydric acid is insoluble in weak alcohol, or in acetic ether, but at higher temperatures it dissolves at once. (Wœhler.)

Sulphydrate of Acetoyl. *Vid.* Hydride of SulphAcetyl.

Sulphydrate of Acetyl. *Vid.* ThiAcetic Acid.

Sulphydrate of Allyl.
(*AllylMercaptan.*)
C_6H_4S, HS

Sulphydrate of Ammonium.
(*Sulphide of Ammonium & of Hydrogen. BiHydroSulphate of Ammonia.*)
NH_4S, HS
Soluble in water, and alcohol. When the aqueous solution is exposed to the air, as when kept in half-filled or badly stoppered bottles, decomposition occurs, hyposulphite of ammonia being formed, and sulphur deposited. The solution, as commonly prepared, also contains more or less bisulphide of ammonium, whence its yellow color. (Berzelius, *Lehrb.*)

Sulphydrate of Amyl.
(*AmylMercaptan. AmylSulphydric Acid.*)
$C_{10}H_{12}S_2 = C_{10}H_{11}S, HS$
Insoluble in water. Easily soluble in alcohol, and ether. [Compare Sulphide of Amyl & of *X.*]

Sulphydrate of AzoBenzoyl.
$C_{42}H_{18}N_2S_3$ (?)
Nearly insoluble in alcohol. Somewhat soluble in hot, less soluble in cold ether. (Laurent.)

Sulphydrate of Barium.
$BaS, HS + x Aq$
Effloresces, with decomposition. Very easily soluble in water. Much more readily soluble in water, either hot or cold, than hydrate of baryta. Very difficultly soluble in alcohol. (Berzelius's *Lehrb.*)

Sulphydrate of BromoMethyl.
$C_2H_3BrS_2 = C_2H_2\left.\begin{matrix}Br\\H\end{matrix}\right\}S_2$

Sulphydrate of Butyl.
(*ButylSulphydric Acid. Butylic Mercaptan. TetrylSulphydric Acid.*)
$C_8H_{10}S_2 = C_8H_9S, HS$
Very sparingly soluble in water. Miscible in all proportions with alcohol, and ether. (Humann, *Ann. Ch. et Phys.*, (3.) **44.** 338.) [See also Sulphide of Butyl & of *X.*]

Sulphydrate of Butyryl.
(*ThioButyric Acid.*)
$C_8H_7O_2S, HS$
Sparingly soluble in water. More easily soluble in alcohol.

Sulphydrate of Calcium.
CaS, HS
Very soluble in water.

Sulphydrate of CarboThiacetonin.
$C_{20}H_{18}N_2S_4, 2HS$
Insoluble in water. Sparingly soluble in ether. Soluble in warm alcohol, with partial decomposition.

Sulphydrate of Carvol.
$C_{20}H_{15}SO_2 = C_{20}H_{14}O_2, HS$
Slowly soluble in boiling, much less soluble in cold alcohol. (Varrentrapp.)

Sulphydrate of Cetyl.
(*Cetylic Mercaptan. CetylSulphydric Acid.*)
$C_{32}H_{34}S_2 = C_{32}H_{33}S, HS$
Insoluble in water. Scarcely at all soluble in cold alcohol. Easily soluble in ether; and, somewhat less easily, in boiling alcohol.

Sulphydrate of Chloride of Aluminum. Deliquescent. Decomposed by water. (Wœhler.)

Sulphydrate of Cinnamoyl. *Vid.* Thio-Cinnol.

"**Sulphydrate of Cyanogen.**" *Vid.* Cyanogen with Sulphydric Acid.

Sulphydrate of Ethyl.
(*EthylSulphydric Acid. Mercaptan.*)
$C_4H_6S_2 = C_4H_5S, HS$
Very sparingly soluble in water. 7 drops of it require 25 grms. of water to dissolve them. (Zeise.) Miscible in all proportions with strong alcohol, and ether. Sparingly soluble in weak alcohol. (Zeise.)

The ethyl sulphides ("mercaptides") of the heavy metals are insoluble in water; some of them dissolve in alcohol. [See Sulphide of Ethyl and of *X.*]

Sulphydrate of Ethylamin. Soluble in water. (Wurtz, *Ann. Ch. et Phys.*, (3.) **30.** 484.)

Sulphydrate of Ethylene. Soluble in alcohol, from which it is not precipitated at first by water; but after a time the aqueous solution decomposes. (Lœwig & Weidmann.)
(*Sulphide of Ethylene & of Hydrogen. Sulphydrate of Sulphide of Elayl.*)
$C_4 H_6 S_4 = C_4 H_4^{ll}, S_2, 2 H S$

Sulphydrate of Harmalin. Soluble in water, with partial decomposition.

Sulphydrate of Harmin.

Sulphydrate of Hydride of ***bi*****Bromo-SulphoSalicyl.** Soluble in alcohol, from which it is precipitated on the addition of water. Soluble in ether. (Heerlein.)
(*SulphobiBromoSalicylous Acid.*)
$C_{14} H_6 Br_2 O_2 S_4 = C_{14} H_4 Br_2 O_2 S_2, 2 H S$

Sulphydrate of HydroKinone.

I.) $C_{24} H_{13} S O_8 = 2 C_{12} H_6 O_4 ; H S$

II.) Permanent. Decomposed by water.
$C_{36} H_{20} S_2 O_{12} = 3 C_{12} H_6 O_4 ; 2 H S$

Sulphydrate of Lithium. Hygroscopic. Easily soluble in water, and alcohol. (Berzelius, *Lehrb.*, **3.** 275.)
$Li S, H S$

Sulphydrate of Magnesium. Soluble in water, the solution undergoing decomposition when heated. Decomposed by acids.
$Mg S, H S$

Sulphydrate of Methyl. Only slightly soluble in water.
(*Methyl Mercaptan.*)
$C_2 H_4 S_2 = \left.\begin{matrix} C_2 H_3 \\ H \end{matrix}\right\} S_2$

Sulphydrate of Methylene. *Vid. proto-*Sulphide of Methyl.

Sulphydrate of Naphtylamin. Soluble in alcohol, but the solution undergoes decomposition when boiled. (Zinin.)

Sulphydrate of Potassium. Deliquescent. Very soluble in water, and in alcohol, with production of cold in both cases. (Berzelius; Vauquelin, *Ann. de Chim.*, **42.** 40 [T.].)
$K S, H S$

Sulphydrate of Sodium.

a = $Na S, H S$ Deliquescent. Soluble in water, and alcohol.

b = *hydrated.* Not sensibly altered by exposure to the air during 24 hours, but slowly deliquesces. When heated it melts in its water of crystallization. (T. Thomson, in his *System of Chem.*, London, 1831, **2.** 903.)
$Na S, H S + 7 Aq$

Sulphydrate of Strontium. Tolerably permanent. Soluble in water; more readily than hydrate of strontia.
$Sr S, H S$

Sulphydrate of SulphAcetyl. See under Hydride of SulphAcetyl.

Sulphydrate of SulphoCarvol. Soluble in ether, from which it is precipitated on the addition of alcohol.
$C_{20} H_{15} S_3 = C_{20} H_{14} S_2, H S$

Sulphydrate of SulphoCyanide of Allyl. *Vid.* AllylSulphoCarbonic Acid.

Sulphydrate of Tin. Ppt. (Kuehn.)
$Sn S_2, H S$

Sulphydric Ether. *Vid.* Sulphide of Ethyl.

SulphHypoSulphuric Acid (of Langlois). *Vid. tri*Thionic Acid.

Sumbulamic Acid. Insoluble in water. Soluble in alcohol.

Sumbulamate of Potash. Soluble in an aqueous solution of caustic potash, from which it is precipitated on the addition of water. (Reinsch.)

Sumbulolic Acid ("*Acide Sumbulique*"). *Vid.* Angelic Acid.

Super-carbonate (&c.) **of** *X.* See under Carbonate (&c.) of *X.*

Surinamin (from *Geoffroya Surinamenis*). Sparingly soluble in cold, easily soluble in hot water. Sparingly soluble in alcohol. Nearly insoluble in ether.
(*Geoffroyin.*)

Sylvic Acid. *Vid.* Resins, of Turpentine.

Synaptase. Soluble in water. Insoluble in alcohol, or ether. (Thomson & Richardson, *Rep. Br. Assoc.*, 1838, p. 49.) Very soluble in cold water. Almost insoluble in alcohol. The aqueous solution soon decomposes when exposed to the air. (Robiquet.) Difficultly soluble in water. Insoluble in alcohol when phosphates are present; but alcohol does not precipitate it from the solution in pure water. (Bull, *Am. J. Sci.*, (2.) **8.** pp. 76, 77, 78.) Easily soluble in acids. (Ortloff.)
(*Emulsin.*)
"$C_{36} H_{35} N_4 O_{24}$"

Syringin (from *Syringa vulgaris*). Soluble in 8 @ 10 pts. of water; and in about the same proportion of alcohol. Insoluble in ether. Soluble in concentrated sulphuric acid. (Bernays.) Insoluble in water, or acids, excepting acetic acid. (Meillet.)
(*Lilacin.*)

T.

Tallows. See Fats.

Tanacetin (from *Tanacetum vulgare*). Soluble in water, and spirit. (Frommherz.)

Tanghinin (from *Tanghinia Thouars*). Efflorescent. Insoluble in water. Soluble in alcohol, and ether. But little acted upon by acids or alkalies.

TannAspidic Acid. Insoluble in water. Very easily soluble in alcohol. Insoluble in ether free from alcohol, or in fatty or essential oils. Soluble in concentrated acetic acid, from which it may be precipitated by adding water. Soluble in concentrated sulphuric and nitric acids. Also soluble in aqueous solutions of the caustic alkalies. (Luck.)
$C_{26} H_{13} O_{10}, H O$

TannAspidate of Ethyl. Insoluble in water. Soluble in alcohol. Insoluble in ether, or in fixed or volatile oils. Soluble in concentrated sulphuric acid.
(*Ethyl Tannaspidic Acid.*)
$C_{56} H_{31} O_{21}$

TannAspidate of Ethyl & of Lead.

I.) Ppt.
$C_{56} H_{31} O_{21}, Pb O$

II.) *basic.* Ppt.

TannAspidate of Lead. Ppt.
$C_{26} H_{13} Pb O_{11}$

Tannic Acid. *Vid.* GalloTannic Acid.

Tannigenamic Acid. *Vid.* Gallamic Acid.

Tanningenic Acid. *Vid.* Catechin.

TannOxylic Acid. Soluble in water acidulated with acetic acid. Insoluble in alcohol.
(*TannoMelanic Acid. Tannyl Oxylic Acid.*)
$C_{14} H_6 O_{12} = C_{14} H_3 O_9, 3 H O$

TannOxylate of Lead. Very sparingly soluble in strong boiling acetic acid. (Buchner.)

TannOxylate of Potash. Soluble in water.

Tantalic Acid. Insoluble in water. (H. Rose.)
$3\,TaO_2, 2\,HO$

Tantalate of Ammonia. Very sparingly soluble in pure water. (H. Rose.)
$NH_4O, 9\,TaO_2 + 6\,Aq$

Tantalate of Baryta. Very sparingly soluble in water. (H. Rose.)
$BaO, 2\,TaO_2$

Tantalate of Magnesia. Ppt.
$MgO, 2\,TaO_2 + 5\,Aq$

Tantalate *of dinoxide* of Mercury. Ppt.
$Hg_2O, 2\,TaO_2 + Aq$

Tantalate of Potash.

I.) Soluble in potash-lye.
KO, TaO_2

II.) $KO, 4\,TaO_2$ } Are precipitated on boiling
III.) $KO, 6\,TaO_2$ } the solution of No. I.

Tantalate of Silver. Ppt. Soluble in ammonia-water. Decomposed by nitric acid. (H. Rose.)
$AgO, TaO_2 + Aq$

Tantalate of Soda.

I.) Soluble in 493 pts. of cold, and in 162 pts. of hot water; the aqueous solution is not altered by boiling, but is decomposed by evaporation, an insoluble acid salt being precipitated. Insoluble in alkaline solutions. (H. Rose.)
$NaO, 2\,TaO_2 + 7\,Aq$

II.) Insoluble in water.
$NaO, 3\,TaO_2 + 2\,Aq$

III.) $NaO, 9\,TaO_2$

IV.) $NaO, 12\,TaO_2$

Tantalum. Permanent. Unacted upon by water, or by an aqueous solution of caustic potash. Insoluble in chlorhydric, nitric, or sulphuric acids, or in aqua-regia. Slowly soluble in fluorhydric acid; quickly soluble in a mixture of fluorhydric and nitric acids. (H. Rose.)
Ta

Tar. Insoluble in water. Soluble in fatty and essential oils, benzin, coal-oils, &c.

Soluble in water acidulated with oxyphenic acid. (Buchner, *Ann. Ch. u. Pharm.*, **96.** 189.)

Taraxacin(from *Taraxacum officinale*). Sparingly soluble in cold, easily soluble in boiling water. Easily soluble in alcohol, ether, and concentrated acids. (Polex.)

Tartanil. *Vid.* PhenylTartrylamid.

Tartanilic Acid. *Vid.* PhenylTartrylamic Acid.

Tartanilid. *Vid. bi*PhenylTartryl*bi*amin.

Tartar Emetic. *Vid.* Tartrate of Antimony and of Potash.

Tartralic Acid(Old, of Fremy). *Vid.* IsoTartaric Acid.

Tartralic Acid(New, of Fremy). [Obtained, according to the most recent statement of this chemist, by heating tartaric acid to 190°. See Pelouze & Fremy, *Traité de Chimie générale*, Paris, 1855, **4.** 226; and *Gmelin's Handbook*, **10.** 333.] Deliquescent.
$2\,C_8H_4O_{10}, 3\,HO$

Tartralate of Baryta. Soluble in water, the solution undergoing decomposition when boiled.

Tartralate of Lead. Insoluble, or very sparingly soluble, in cold water.

Tartralate of Lime. Soluble in water, the solution undergoing decomposition when boiled.

Tartralate of Strontia. Soluble in water; the solution undergoing decomposition when boiled.

Tartramethane. *Vid.* Tartramate of Ethyl.

Tartramic Acid.
$C_8H_7NO_{10} = N\left\{\begin{matrix}C_8H_4O_8'' \\ H_2\end{matrix}\right. .O, HO$

Tartramate of Ammonia. Soluble in all proportions in water. Insoluble in alcohol. (Laurent, *Ann. Ch. et Phys.*, (3.) **23.** 116.)

Tartramate of Ethyl.
(*Tartramethane.*)
$C_8H_6(C_4H_5)NO_{10}$

Tartramate of Lime. Insoluble in alcohol. (Laurent, *loc. cit.*)
$C_8H_6CaNO_{10}$

Tartramid. There are two modifications of tartramid (right and left), but they do not differ from each other in solubility. Soluble in water. (Pasteur.)
$C_8H_8N_2O_8 = N_2\left\{\begin{matrix}C_8H_4O_8'' \\ H_4\end{matrix}\right.$

Tartramylic Acid. *Vid.* AmylTartaric Acid.

Tartaric Acid(amorphous). *Vid.* Meta-Tartaric Acid.

Tartaric Acid(anhydrous). There are two isomeric modifications: one soluble in water (*vid.* Tartrelic Acid), the other insoluble in water. This last is insoluble in cold water, alcohol, or ether; but when left in contact with water for several hours, it is converted into ordinary tartaric acid; this transformation is effected more rapidly by boiling water. (Fremy.)
(*Tartaric Anhydride.*)
$C_8H_4O_{10} = C_8H_4O_8''\}O_2$

Tartaric Acid(ordinary). Permanent. There are two modifications (right and left). The ordinary acid is the "right" modification; but the solubility of both the modifications is the same. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** 71.)
(*Weinsæure*, or *Weinsteinsæure.*)
$C_8H_6O_{12} = C_8H_4O_{10}, 2\,HO$

By direct experiment Pasteur found that 1 pt. of right tartaric acid is soluble in 1.326 pts. of water at 19° @ 20°; and that 1 pt. of left tartaric acid is soluble in 1.322 pts. of water at the same temperature. (*Ann. Ch. et Phys.*, (3.) **28.** 73.) Crystallized tartaric acid is soluble in 0.727 pt. of water at 15°. (Gerlach's determination, see his table of sp. grs., below.) Soluble in 0.538 pt. of cold water, and in less hot water. (Gmelin's *Handbook.*) The dilute aqueous solution is decomposed after a time. Soluble in 2 pts. of cold, and in 1 pt. of hot water. (Wittstein's *Handw.*) Soluble in 4 pts. of water at 15.5°, and in 0.5 pt. of boiling water; the solution saturated at 15.5° contains 20% of it, and the boiling saturated solution 66.66%. Soluble in 1.714 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)

Percentage of Crystallized Tartaric Acid ($C_8H_4O_{10} + 2\,Aq$) *in Aqueous Solutions.*

Sp. gr. (at 15°).	Percent of crystallized acid.
1.0045	1
1.0090	2
1.0136	3
1.0179	4
1.0224	5
1.0273	6
1.0322	7
1.0371	8
1.0420	9

Sp. gr. at (15°).	Percent of crystallized acid.
1.04692	10
1.0517	11
1.0565	12
1.0613	13
1.0661	14
1.0709	15
1.0761	16
1.0813	17
1.0865	18
1.0917	19
1.09693	20
1.1020	21
1.1072	22
1.1124	23
1.1175	24
1.1227	25
1.1282	26
1.1338	27
1.1393	28
1.1449	29
1.15047	30
1.1560	31
1.1615	32
1.1670	33
1.1726	34
1.1781	35
1.1840	36
1.1900	37
1.1959	38
1.2019	39
1.20785	40
1.2138	41
1.2198	42
1.2259	43
1.2317	44
1.2377	45
1.2441	46
1.2504	47
1.2568	48
1.2632	49
1.26962	50
1.2762	51
1.2828	52
1.2894	53
1.2961	54
1.3027	55
1.3093	56
1.3159	57
1.3220	57.9*

(Gerlach, *Sp. Gew. der Salzlœsungen*, 1859, p. 24.)

* Saturated solution.

An aqueous solution of sp. gr. (at 15°).	Contains (by experiment) percent of the crystallized acid $C_8 H_6 O_{12}$.
1.0167	3.67
1.0337	7.33
1.0511	11.
1.0690	14.66
1.1062	22.
1.1654	33.

From these results Schiff deduces the formula: $D = 0.0044637\ p + 0.000016529\ p^2$; in which D = the sp. gr. of the solution, and p the percentage of substance in the solution, by means of which Ott has calculated the following table.

Sp. gr. (at 15°).	Percent of $C_8 H_6 O_{12}$.
1.0045	1
1.0090	2
1.0135	3
1.0181	4
1.0227	5
1.0274	6
1.0321	7
1.0368	8
1.0415	9
1.0463	10
1.0511	11
1.0559	12
1.0608	13
1.0657	14
1.0707	15
1.0757	16
1.0807	17
1.0857	18
1.0908	19
1.0859	20
1.1010	21
1.1062	22
1.1114	23
1.1166	24
1.1219	25
1.1272	26
1.1325	27
1.1379	28
1.1433	29
1.1488	30
1.1543	31
1.1598	32
1.1653	33
1.1709	34
1.1765	35
1.1821	36
1.1878	37
1.1935	38
1.1992	39
1.2050	40
1.2108	41
1.2166	42
1.2225	43
1.2884	44
1.2343	45
1.2403	46
1.2463	47
1.2523	48
1.2584	49
1.2645	50

(H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 189.)

Sp. gr.	Percent of cryst. acid.
1.04	9.06
1.08	17.45
1.12	24.98
1.16	32.06
1.20	39.04
1.24	46.03
1.28	52.59
1.32	58.75
1.36	64.56

(Richter, in *Gmelin's Handbook*, **10.** 271.)

1.0086	1.63
1.0235	5.00
1.0678	14 28
1.1090	22.27
1.1217	25.01
1.1553	30.76
1.1740	34.24
1.2078	40.00
1.2736	51.42

(Osann, *Kastner's Archiv.*, 1824, **3.** 370.)

From these experimental results Osann deduces the formula: $y = 0.01729\ x + 4.1$, by which to calculate the percentage for any sp. gr. between 1.1217 and 1.2736; in this formula $x =$ the sp. gr. of the solution, and y the percentage of acid in the solution.

An aqueous solution containing 25% of crystallized tartaric acid, boils at 102.2°; one of 50% boils at 106.7°. (Gerlach's *Sp. Gew. der Salzlœsungen*, p. 111.)

Soluble in 2.06 pts. of alcohol, of 80%, at 15°; or 100 pts. of 80% alcohol at 15°, dissolve 49 pts. of it; or, the solution in 80% alcohol, saturated at 15°, contains 33% of it, and its sp. gr. is 0.999. (H. Schiff, *Ann. Ch. u. Pharm.*, 1860, **113.** 189.) Readily soluble in alcohol; more soluble in wood-spirit. Insoluble in ether.

Entirely insoluble in pure oil of turpentine. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** 67.) Insoluble in caoutchin, but is decomposed when boiled with it. (Himly.) Soluble in boiling creosote, the solution solidifying as it becomes cold. (Reichenbach.)

Right and left tartaric acids, as well as their compounds, have identical solubilities so long as they are contained in combinations which exert no action upon polarized light; but when united with bodies which have any molecular action whatsoever on the plane of polarization, then their identity ceases, and they have no longer the same solubility. (Pasteur, *Ann. Ch. et Phys.*, (3.) **38.** pp. 460, 461.)

The normal tartrates, excepting those of the alkalies, are but sparingly soluble, or insoluble, in water; the acid salts, on the other hand, are mostly soluble, except those of the alkalies. All the metallic tartrates, which are insoluble in water, are soluble in chlorhydric and nitric acids, and, excepting those of silver and mercury, in aqueous solutions of caustic potash and soda; also in ammonia-water, excepting tartrate of mercury.

On the addition of a small portion of a ferment to dilute aqueous solutions of the alkaline tartrates, exposed to the air in a tolerably warm place, decomposition rapidly ensues, the salt being converted into a carbonate. (Buchner, Jr., *Ann. Ch. u. Pharm.*, 1851, **78.** 207.)

Tartrate of Allyl. Soluble in ether. Decomposed by alkaline solutions.

Tartrate of Alumina. $C_{24}H_{12}(Al_2''')_2O_{36}$ Permanent. Readily soluble in water. (v. Pæcken.) Not precipitated by the alkalies, or alkaline carbonates. (H. Rose.)

Tartrate of Alumina & Potash. Permanent. Very easily soluble in water. (Vogel.)

Tartrate of Ammonia.

I.) *normal.* $C_8H_4(NH_4)_2O_{12}$ Efflorescent, with loss of ammonia. Very soluble in water, but more easily in *cold* than in hot water.

II.) *acid.* $C_8H_5(NH_4)O_{12}$ Very sparingly soluble in cold, readily soluble in boiling water. Completely insoluble in absolute alcohol. (Nœllner.)

100 pts. of water at 15° dissolve 2.192 pts. of right bitartrate of ammonia. (Pasteur, *Ann. Ch. et Phys.*, (3.) **38.** 464.) The right bitartrate combines with active bimalate of ammonia (*q. vid.*), but the left bitartrate does not thus combine, and is less soluble in a solution of active bimalate of ammonia than in pure water. (Pasteur, *loc. cit.*, p. 465.) More soluble in water than bitartrate of potash, which in other respects it resembles closely, being, like it, soluble in aqueous solutions of caustic potash, soda, and ammonia, and of the alkaline carbonates, as well as in the stronger acids. (H. Rose, *Tr.*)

Tartrate of Ammonia & of Antimony. (*Ammoniacal Tartar Emetic.*) $C_8H_4Sb'''(NH_4)O_{14} + Aq\ \&\ 5\ Aq$ Efflorescent. Much more soluble in water than the corresponding potash salt.

Tartrate of Ammonia & of Arsenic. $C_8H_4As'''(NH_4)O_{14} + Aq$ Efflorescent. More soluble than arsenious acid in water. (Mitscherlich.)

Tartrate of Ammonia & of Iron (Fe_2O_3). $C_8H_4Fe_2'''(NH_4)O_{14} + 4\ Aq$ Soluble in a little more than 1 pt. of water, and the aqueous solution is not decomposed by long-continued boiling. Alcohol precipitates it from the aqueous solution. (Procter, *Amer. J. Pharm.*)

Tartrate of Ammonia & of Lead.

Tartrate of Ammonia & of Lime. The aqueous solution of bitartrate of lime is not precipitated by ammonia. (Thénard [T.].)

Tartrate of Ammonia & of Magnesia. Easily soluble in water, being much more soluble than normal tartrate of magnesia. Decomposed by ammonia-water. (W. Mayer, *Ann. Ch. u. Pharm.*, **101.** 166.) Very readily soluble in a solution of sulphate of ammonia, less soluble in a solution of chloride of ammonium. (Field.)

Tartrate of Ammonia & of Potash. $C_8H_4(NH_4)KO_{12}$ Efflorescent. Soluble in 2 pts. of cold, and in less than 1 pt. of boiling water. (Wittstein's *Handw.*) Soluble in 2 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.) Very soluble in water. In consequence of the ammonia-salt being less soluble, this compound has a tendency to contain more than one equivalent of ammonia. Thus Rammelsberg describes a salt of the following composition, $C_8H_4(NH_4)_{\frac{6}{5}}K_{\frac{4}{5}}O_{12} + Aq$.

Tartrate of Ammonia & of Soda. $C_8H_4(NH_4)NaO_{12} + 8\ Aq$ The solubility of both the right and left tartrate of ammonia and soda is the same; by direct experiment it was found that 1 pt. of the right tartrate is soluble in 3.706 pts. of water at 0°; and 1 pt. of the left tartrate in 3.742 pts. of water at 0°. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** 91.)

Tartrate of Ammonia & *of protoxide* of Uranium. Resembles the corresponding potash-salt.

Tartrate of AmmoniumChloroPlatin(*ous*)ammonium. (*Gros's Tartrate.*) Somewhat soluble in water. (Gros, *Ann. der Pharm.*, 1838, **27.** 256.)

Tartrate of Anilin. More soluble in boiling than in cold water. (Hofmann, *Ann. Ch. et Phys.*, (3.) **9.** 155.)

Tartrate of Anisamate of Ethyl. Soluble in alcohol. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** pp. 346, 347.)

Tartrate of Antimony.

I.) *normal.* $C_{24}H_9(Sb''')_2O_{42}$ (?) or $SbO_3, 3\ C_4H_3O_6$ Hygroscopic. Easily soluble in water. Alcohol precipitates No. II. from the aqueous solution. (Berzelius, *Lehrb.*, **3.** 1124.)

II.) *di.* Insoluble in water or alcohol. Soluble in a solution of normal tartrate of potash, and in most other soluble tartrates, with combination. (Berzelius.)
$2\ Sb\ O_3,\ C_8\ H_6\ O_{12} + 2\ Aq$

III.) *acid.* Insoluble in alcohol. (Péligot, *Ann. Ch. et Phys.*, (3.) **20.** 290.)
$Sb\ O_3,\ C_8\ H_4\ O_{10}(?)$

IV.) *peracid.* Deliquesces in moist air. Very soluble in water. (Péligot, *loc. cit.*, p. 289.)
$Sb\ O_3,\ C_{16}\ H_{16}\ O_{28}\ ?$

TARTRATE OF ANTIMONY & OF BARYTA. Ppt.
$C_8\ H_4\ Ba\ Sb'''\ O_{14} + 2\ Aq$

TARTRATE OF ANTIMONY & OF CADMIUM. Ppt.
$C_8\ H_4\ Sb'''\ Cd\ O_{14}$

TARTRATE OF ANTIMONY & OF CHROMIUM. Ppt.
$C_8\ H_4\ Cr_2'''\ Sb'''\ O_{16}$

TARTRATE OF ANTIMONY & *of sesquioxide* OF IRON. Ppt.
$C_8\ H_4\ Fe_2'''\ Sb'''\ O_{16}$

TARTRATE OF ANTIMONY & OF LEAD. Ppt.
$C_8\ H_4\ Sb'''\ Pb\ O_{14}$

TARTRATE OF ANTIMONY & OF LIME. Ppt.
$C_8\ H_4\ Sb'''\ Ca\ O_{14}$

TARTRATE OF ANTIMONY & OF LITHIA.
$C_8\ H_4\ Sb'''\ Li\ O_{14} + 5\ Aq$

TARTRATE OF ANTIMONY & OF POTASH.

I.) *normal.* Effloresces superficially. Soluble in 14.5 pts. of cold, and in 1.88 pts. of boiling water. (Bucholz.)
(*Tartar Emetic.*)
$C_8\ H_4\ Sb'''\ K\ O_{14} + Aq$

[In *Brandes's Archiv.* (**3.** 223), R. Brandes & Firnhaber have published statements concerning the solubility of tartar emetic, which have been copied into many text-books of chemistry; but the figures of the article in question exhibit little accordance among themselves, and are in several instances manifestly erroneous. In the statements of the immediate results of their experiments, the figures indicate that the substance weighed by these chemists in their determinations was the anhydride $C_8\ H_2\ K\ Sb\ O_{12}$ [Eq. = 307.2]. Starting from this inference, I have recalculated each of their experiments from the statement of "dry residue found"; estimating the ordinary crystallized salt as $C_8\ H_5\ K\ Sb\ O_{15}$ [Eq. = 334.2*]. See the following table.]

1 pt. of the crystallized salt is soluble in		
18.80	pts. of water at	8.75°
11.42	"	21.25°
7.13	"	31.25°
5.61	"	37.5°
4.54	"	50°
3.76	"	62.5°
2.18	"	75°
2.02	"	87.5°
1.76	"	100°

Or, 100 pts. of water at		
8.75°	dissolve	5.320 pts. of it.
21.25°	"	8.756 "
31.25°	"	14.021 "
37.5°	"	17.830 "
50°	"	22.025 "
62.5°	"	26.608 "
75°	"	45.933 "
87.5°	"	49.541 "
100°	"	56.895 "

Or, the aqueous solution saturated at °C.	Contains per-cent of it.
8.75°	5.05
21.25°	8.05
31.25°	12.30
37.5°	15.13
50°	18.05
62.5°	21.02
75°	31.48
87.5°	33.13
100°	36.26

(From the data given by R. Brandes & Firnhaber, *Brandes's Archiv.*, 1823, **3.** 223.)

100 pts. of water at 15.5° dissolve 6.6 pts. of it.
" " 100° " 33 "
" " 100° " 50 "
(Ure's *Dict.*)

Soluble in 16 pts. of water at 18.75. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.) It is liable to form supersaturated solutions. (Ogden.)

Insoluble in alcohol.

Freely soluble in glycerin. (Parrish's *Pharm.*, p. 236.)

The aqueous solution soon decomposes, but a solution prepared by dissolving 1 pt. of the salt in 50 pts. of water, and adding 10 pts. of alcohol, may be kept. (Harms, *Ann. Ch. u. Pharm.*, **96.** 128.)

II.) *acid.* Efflorescent. More soluble than the preceding salt in water. Alcohol precipitates the preceding salt when added to the aqueous solution. (Knapp.)
$C_8\ H_4\ Sb'''\ K\ O_{14}\ ;\ C_8\ H_8\ O_{12} + 2\ Aq$

III.) Sparingly soluble in water, from which it is precipitated on the addition of alcohol. (Knapp.)
$C_8\ H_4\ Sb'''\ K\ O_{14}\ ;\ 3\ C_8\ H_5\ K\ O_{12} + 3\ Aq$

IV.) $C_8\ H_4\ Sb'''\ K\ O_{14}\ ;\ 6\ C_8\ H_4\ K_2\ O_{12}$ (Knapp.)

TARTRATE OF ANTIMONY & OF SILVER. Ppt.
$C_8\ H_4\ Sb'''\ Ag\ O_{14} + 2\ Aq$

TARTRATE OF ANTIMONY & OF SODA. Hygroscopic.
$C_8\ H_4\ Sb'''\ Na\ O_{14} + Aq$

TARTRATE OF ANTIMONY & OF STRONTIA. Almost insoluble in boiling water; much more soluble in an aqueous solution of nitrate of strontia.
$C_8\ H_4\ Sb'''\ Sr\ O_{14}$

TARTRATE OF ANTIMONY & OF URANIUM. Soluble in boiling, but exceedingly sparingly soluble in cold water. (Péligot, *Ann. Ch. et Phys.*, (3.) **12.** 566.)
$C_8\ H_4\ Sb\ Ur_2\ O_{16} + 2\ Aq = \left.\begin{matrix} C_8\ H_4\ O_8'' \\ Sb'''\ .\ Ur_2''' \end{matrix}\right\}O_8 + 2\ Aq\ \&\ 9\ Aq$

TARTRATE OF ARSENIC(As O_3) & OF POTASH. Efflorescent.
$C_8\ H_4\ As\ K\ O_{14} + Aq = \left.\begin{matrix} C_8\ H_4\ O_8'' \\ K\ .\ As''' \end{matrix}\right\}O_6 + Aq$

TARTRATE OF ARSENIC(As O_5) & OF POTASH. Very soluble in water, but the solution soon decomposes, unless free arsenic acid is present. Alcohol precipitates it from the aqueous solution. (Pelouze, *Ann. Ch. et Phys.*, (3.) **6.** 64.)
$C_8\ H_4\ As\ K\ O_{16} + 5\ Aq = \left.\begin{matrix} C_8\ H_4\ O_8'' \\ K\ .\ As^{v} \end{matrix}\right\}O_8 + 5\ Aq$

TARTRATE OF ASPARAGIN. Soluble in water. ?

TARTRATE OF AZONAPHTYLAMIN. Tolerably soluble in water, and alcohol; less soluble in ether.

TARTRATE OF BARYTA.

I.) *normal.* Soluble in from 400 @ 1000 pts. of water; less easily soluble after
$C_8\ H_4\ Ba_2\ O_{12}$

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* The equivalent of antimony, after Dexter, = 122.

drying. (Bolle.) Easily soluble in tartaric acid. Soluble in an aqueous solution of tartrate of ammonia.

When recently precipitated, it is soluble in a cold aqueous solution of chloride of ammonium, and also, though less readily, in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.) Unlike the tartrates of lime and strontia, its solutions in the fixed caustic alkalies do not coagulate when heated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** 290.) Insoluble in an aqueous solution of chloride of ammonium. (Wittstein.) Soluble in an aqueous solution of normal citrate of soda. (Spiller.)

II.) *bi.* $C_8 H_5 Ba O_{12} + 2 Aq$ 100 pts. of water at 18.3° dissolve 1.24 pts. of it. (Thomson's *System of Chem.*, London, 1831, **2.** 488.)

Tartrate of Baryta & of Potash. $C_8 H_4 K Ba O_{12} + 2 Aq$ Very sparingly soluble in water. (Dulk.)

Tartrate of Baryta & of Soda. $C_8 H_4 Na Ba O_{12} + 2 Aq$ Sparingly soluble in water; more soluble in aqueous solutions of Rochelle salts, and of chloride of barium. (Kaiser.)

Tartrate of Benzidin. Much more soluble in water than benzidin.

Tartrate of Bismuth. Decomposed by pure water. Insoluble in cold dilute tartaric acid.

$2 Bi O_3, 3 C_8 H_4 O_{10} = \left.\begin{matrix} 3 C_8 H_4 O_8'' \\ 2 Bi''' \end{matrix}\right\} O_{12} + Aq$ & $6 Aq$

Tartrate of Bismuth & of Potash. Decomposed by water. (Schwarzenberg.)

$C_8 H_4 (Bi''')_2 O_{12} ; C_8 H_4 K_2 O_{12}$

Tartrate of Boron(B O₃) & of Lime, with Tartrate of Lime. Soluble in 257 pts. of water. (Wittstein.)

$\left.\begin{matrix} B''' \\ Ca . C_8 H_4 O_8'' \end{matrix}\right\} O_6 ; 3 \left.\begin{matrix} C_8 H_4 O_8'' \\ H . Ca \end{matrix}\right\} O_4 + 2 Aq$

Tartrate of Boron(B O₃) & of Potash. (*Soluble Cream of Tartar. Boro Tartrate of Potash.*)

I.) Permanent. Soluble in 0.75 pt. of cold, and in 0.25 pt. of boiling water. Insoluble in alcohol. (Berzelius's *Lehrb.*) Soluble in 1 pt. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)

$C_8 H_4 B K O_{14} = \left.\begin{matrix} C_8 H_4 O_8'' \\ B''' . K \end{matrix}\right\} O_6$ & $+ 2 Aq$

II.) Readily soluble in water. Sparingly soluble in alcohol of 25° B.

$C_8 H_4 B K O_{14} ; C_8 H_5 K O_{12} = \left.\begin{matrix} C_8 H_4 O_8'' \\ B''' . K \end{matrix}\right\} O_6 + \left.\begin{matrix} C_8 H_4 O_8'' \\ H . K \end{matrix}\right\} O_4$

III.) Permanent. Easily soluble in water. Slightly decomposed by alcohol, which also dissolves a trace of it as such. (Wittstein.)

$C_{16} H_{12} K B_2 O_{31} = \left.\begin{matrix} C_8 H_4 O_8'' \\ B'' . K \end{matrix}\right\} O_6 ; \left.\begin{matrix} C_8 H_4 O_8'' \\ B''' . H \end{matrix}\right\} O_6 + 3 Aq$

Tartrate of Boron(B O₃), of Potash, & of Soda. (*Borotartrate of Soda.*) Slowly deliquescent. Very easily soluble in water. Insoluble in, or decomposed by, alcohol. (Duflos.)

$\left.\begin{matrix} B''' \\ K . C_8 H_4 O_8'' \end{matrix}\right\} O_6 ; \left.\begin{matrix} B''' \\ Na . C_8 H_4 O_8'' \end{matrix}\right\} O_6 ; \left.\begin{matrix} B''' \\ H . C_8 H_4 O_8'' \end{matrix}\right\} O_6 + 12 Aq$

[There are several other compounds.]

Tartrate of Boron(B O₃) & of Soda. As hygroscopic as borax. Easily soluble in water. Slightly decomposed by alcohol, which also dissolves traces of it as such. (Wittstein.)

$C_{16} H_{12} Na B_2 O_{31} = \left.\begin{matrix} C_8 H_4 O_8'' \\ B''' . Na \end{matrix}\right\} O_6 ; \left.\begin{matrix} C_8 H_4 O_8'' \\ B''' . H \end{matrix}\right\} O_6 + 3 Aq$

Tartrate of Brucine.

I.) *normal.*

a = "*right.*" Efflorescent, though less so than the left salt. Sparingly soluble in cold, exceedingly soluble in warm water. Sparingly soluble in cold alcohol, being less soluble therein than the left salt. (Pasteur, *Ann. Ch. et Phys.*, (3.) **38.** 472.)

$C_8 H_4 \left(N_2 \left\{ C_{46} H_{26} O_8^{vi} . H \right. \right)_2 O_{12} + 6 Aq$ & $11 Aq$

b = *left.* Very efflorescent. Sparingly soluble in cold, exceedingly soluble in warm water. More soluble in alcohol than the right salt. (Pasteur, *loc. cit.*)

$C_8 H_4 \left(N_2 \left\{ C_{46} H_{26} O_8^{vi} . H \right. \right)_2 O_{12} + 28 Aq$

II.) *acid.*

a = *right.* Soluble in water. Very sparingly soluble in cold, more soluble in hot alcohol. (Pasteur, *loc. cit.*, pp. 472, 473.)

$C_8 H_5 \left(N_2 \left\{ C_{46} H_{26} O_8^{vi} . H \right. \right) O_{12}$

b = *left.* Effloresces in dry air. Very sparingly soluble in cold, exceedingly soluble in warm water. Soluble in alcohol. (Pasteur, *loc. cit.*)

$C_8 H_5 \left(N_2 \left\{ C_{46} H_{26} O_8^{vi} . H \right. \right) O_{12} + 9 Aq$

Tartrate of Cadmium. $C_8 H_4 Cd_2 O_{12}$ Difficultly soluble in water.

Tartrate *of protoxide* of Cerium. $C_8 H_4 Ce_2 O_{12}$ Sparingly soluble in water. Readily soluble in aqueous solutions of caustic potash and soda, and still more soluble in ammonia-water. No more soluble in tartaric acid than in water. (Berzelius.)

*Bi*Tartrate of Cesium. $C_8 H_5 Cs O_{12}$ Soluble in 10.32 pts. of water at 25°, and in 1.02 pts. of boiling water; being about 8 times as soluble as the corresponding rubidium salt. (Allen, *Am. J. Sci.*, 1862, **34.** pp. 372, 373.)

Tartrate *of sesquioxide* of Chromium.

I.) *normal.* $C_{24} H_{12} (Cr_2''')_2 O_{36}$ Efflorescent. Easily soluble in water. (Moser.) Not precipitated by alkaline solutions.

II.) *basic.* $C_{16} H_8 (Cr_2''')_2 O_{24}$ Soluble in water. (Berzelius's *Lehrb.*, **3.** 1092.)

Tartrate of Chromium & of Lead. Ppt. $C_8 H_4 Cr_2''' Pb O_{14}$

Tartrate of Chromium & of Potash. $C_6 H_4 Cr_2''' K O_{14} + 7 Aq$ Slowly soluble in cold water, but quickly and abundantly in hot water. Insoluble in alcohol.

Tartrate of Chromium & of Silver. $C_8 H_4 Cr_2''' Ag O_{14}$

Tartrate of Cinchonicin. The right salt is more soluble in water than the left salt.

Tartrate of Cinchonidin (of Pasteur).

I.) *normal.* Readily soluble in water.

II.) *acid.* Very difficultly soluble in water. (Leers, *Ann. Ch. u. Pharm.*, **82.** 160.)

Tartrate of Cinchonin.

I.) *normal.* Sparingly soluble in water. (Arppe.)

$C_8 H_4 \left(N_2 \left\{ C_{40} H_{24} O_2^{vi} . H \right. \right)_2 O_{12} + 4 Aq$

II.) *acid.*

a = *right.* Very sparingly soluble in cold, much more soluble in warm water. Very soluble in absolute alcohol. (Pasteur, *Ann. Ch. et Phys.*, (3.) **38.** pp. 470, 472.)

$C_8\,H_5\left(N_2\left\{C_{40}\,H_{24}\,O_2^{VI}\,.\,H\right)O_{12} + 8\,Aq\right.$

b = *left.* Extremely sparingly soluble in water, and alcohol. 100 pts. of absolute alcohol at 19° dissolve 0.296 pt. of the crystallized salt, or 1 pt. of the latter is soluble in 337.8 pts. of absolute alcohol at 19°. (Pasteur, *loc. cit.*)

$C_8\,H_5\left(N_2\left\{C_{40}\,H_{24}\,O_2^{VI}\,.\,H\right)O_{12} + 2\,Aq\right.$

Tartrate of Cobalt. Soluble in water. Not precipitated by the caustic or carbonated alkalies.

$C_8\,H_4\,Co_2\,O_{12}$

Tartrate of Cobalt & of Potash.

$C_8\,H_4\,Co\,K\,O_{12}$

Tartrate of Codein.

Tartrate of Coniin. Soluble in water.

Tartrate *of protoxide* **of Copper.** Soluble in 1715 pts. of cold, and in 310 pts. of boiling water. (Werther.) Insoluble in cold water, but dissolves in more than 1000 pts. of boiling water. (Trommsdorff.) Soluble in an aqueous solution of caustic potash and soda, and in 2.5 pts. of carbonate of potash in aqueous solution. Easily soluble in a boiling, but nearly insoluble in cold dilute aqueous solution of carbonate of soda. Soluble in cold nitric acid. Insoluble in tartaric acid.

$C_8\,H_4\,Cu_2\,O_{12} + 6\,Aq$

Tartrate of Copper(Cu O) & of Potash. Readily soluble in water. Insoluble in alcohol. (Werther.)

$C_8\,H_4\,Cu\,K\,O_{12}$

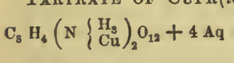
Tartrate of Copper & of Soda.

I.) *basic.* Somewhat difficultly soluble in cold, but easily soluble in warm water. Insoluble in alcohol. (Werther.)

$C_8\,H_4\,Cu\,Na\,O_{12}\,;\,2\,Cu\,O + 7\,Aq$

Tartrate of Cumidin.

Tartrate of Cupr(*ic*)ammonium. Permanent. Soluble in ammonia-water, from which it is precipitated on the addition of alcohol. (Du Menil.)



$C_8\,H_4\left(N\left\{\begin{matrix}H_3\\Cu\end{matrix}\right.\right)_2O_{12} + 4\,Aq$

Tartrate of Emetin. Readily soluble in water.

Tartrate of Ethyl.

I.) *normal.* Very easily soluble in water. Miscible with ether in all proportions. (Demondesir.)

$C_8\,H_4\,(C_4\,H_5)_2\,O_{12}$

II.) *acid.* *Vid.* EthylTartaric Acid.

$C_8\,H_5\,(C_4\,H_5)\,O_{12}$

Tartrate of Ethylamin.

I.) *acid.* Soluble in water, and alcohol. (E. Meyer.)

Tartrate of Furfurin.

I.) *acid.* Permanent. Soluble in water. (Svanberg & Bergström.)

Tartrate of Glucina. Readily soluble in water. (Vauquelin.)

$C_{24}\,H_{12}\,(Gl_2{}''')_2\,O_{36}$

Tartrate of Glycocoll. Soluble in water. When alcohol is added to the aqueous solution an oily fluid separates. (Horsford, *Am. J. Sci.*, (2.) **4.** 63.)

Tartrate of Guanin.

$3\,C_{10}\,H_5\,N_6\,O_2,\ 2\,C_8\,H_6\,O_{12} + 4\,Aq$

Tartrate *of protoxide* **of Iron.**

a = *anhydrous.* Difficultly soluble in water. Soluble in 1127 pts. of cold water [about 1200 pts. of water at 15° (Wittstein's *Handw.*, & Berzelius's *Lehrb.*)]. (Dulk.) Readily soluble in alkaline solutions.

$C_8\,H_4\,Fe_2\,O_{12}$

b = *hydrated.* Soluble in 426 pts. of cold water, and in 402 pts. of boiling water. (Bucholz.) It is not precipitated by the alkalies or alkaline carbonates. Persoz mentions a "tartrate of iron" which is insoluble in water. (*Ann. Ch. et Phys.*, (2.) **63.** 278.)

Tartrate *of sesquioxide* **of Iron.** Tolerably permanent. Easily soluble in water, the aqueous solution undergoing partial decomposition when boiled. Not precipitated by alkalies. Insoluble in alcohol or ether. (Wittstein.)

$C_{24}\,H_{12}\,(Fe_2{}''')_2\,O_{36} + 6\,Aq$

Soluble basic compounds may be obtained, though not so easily as with many other acids; three equivalents of tartaric acid being required to take up two equivalents of ferric oxide. (Ordway, *Am. J. Sci.*, 1858, (2.) **26.** 202.) Not precipitated by caustic alkalies.

Tartrate *of protoxide & sesquioxide* **of Iron.**

I.) Soluble in 384 pts. of cold, and in 320 pts. of boiling water. (Bucholz.)

$C_8\,H_4\,Fe_2\,O_{12}\,;\ C_{24}\,H_{12}(Fe_2{}''')_2\,O_{36} + 4\,Aq$

II.) Resembles the normal tartrate of sesquioxide of iron. (Wittstein.) The aqueous solution is decomposed by continuous boiling.

$C_8\,H_4\,Fe_2\,O_{12}\,;\ 3(C_{24}\,H_{12}(Fe_2{}''')_2\,O_{36}) + 24\,Aq$

III.) *basic.* Insoluble in water, alcohol, or ether. Acetic acid only dissolves traces of it. Completely soluble in much tartaric acid. Easily soluble in the mineral acids. Insoluble in ammonia-water. (Wittstein.)

$C_8\,H_4\,Fe_2\,O_{12}\,;\ 3\,(C_{12}\,H_8(Fe_2{}''')_2\,O_{24})$

Tartrate *of protoxide* **of Iron & of Potash.** Sparingly soluble in water.

$C_8\,H_4\,Fe\,K\,O_{12}$

Tartrate *of sesquioxide* **of Iron & of Potash.**

I.) *normal.* Hygroscopic. Soluble in 7 pts. of water. (Parrish's *Pharm.*, p. 518.) The dry salt is soluble in 4 pts. of water, and is also slightly soluble in alcohol. (Bucholz [T.].) Insoluble in alcohol.

$C_8\,H_4\,K\,Fe_2{}'''\,O_{14}$

II.) *basic.* There are numerous other basic salts more or less soluble in water; most of them being but partially soluble, however.

Bitartrate of potash can dissolve two equivalents of hydrated sesquioxide of iron, making $2\,Fe_2\,O_3,\ K\,O,\ C_8\,H_4\,O_{10}$. (Ordway, *Am. J. Sci.*, 1858, (2.) **26.** 202.)

Tartrate of Lanthanum. Soluble in ammonia-water. (Berzelius.)

Tartrate of Lead. Almost entirely insoluble in water. (Pasteur, *Ann. Ch. et Phys.*, (3.) **28.** 65.) Very soluble in tartaric and nitric acids, from which it is not precipitated on the addition of alcohol. Easily soluble in an aqueous solution of tartrate of ammonia. Soluble in warm solutions of the nitrate and succinate of ammonia, and imperfectly in carbonate of ammonia. (Wittstein.) Soluble in nitric, but insoluble in acetic acid. (Persoz, *Chim. Moléc.*, p. 354, *text and note.*) When recently precipitated it is soluble in a cold aqueous solution of chloride of ammonium; the lead may be reprecipitated from this solution by adding an

$C_8\,H_4\,Pb_2\,O_{12}$

excess of caustic ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** pp. 96, 99.) Soluble in a strong aqueous solution of chloride of sodium; from the solution thus obtained crystals of a double salt of tartrate and chloride of lead separate out after a time. (Becquerel, *C. R.*, 1845, **20.** pp. 1523, 1525.) Soluble in aqueous solutions of the caustic alkalies.

Tartrate of Lead & of Potash. $C_8 H_4 Pb K O_{12}$ Insoluble in water, and is not decomposed by aqueous solutions of the alkaline sulphates or carbonates. (Thénard.)

Tartrate of Lime.

I.) *normal.* $C_8 H_4 Ca_2 O_{12} + 8 Aq$ Very sparingly soluble in cold, somewhat more soluble in boiling water.

Soluble in 1995 pts. of water at 8°.
“ 906 “ “ at 80°. (Osann.)
“ 600 “ boiling water.
“ 1210 “ cold “
“ 350 “ boiling “

(Casselmann, *J. Ch. Soc.*, **8.** 306; from *Arch. Pharm.*, **83.** 148.)

Insoluble in cold water; but 100 pts. of boiling water dissolve 0.16 pt. of it. (Ure's *Dict.*) Easily soluble in the mineral acids, acetic acid, tartaric acid, in an aqueous solution of bitartrate of potash, or of any of the soluble tartrates. When recently precipitated it is soluble even in cold aqueous solutions of chloride of ammonium and nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.) This solution does not occur, however, after the precipitate has become crystalline. (Wittstein.) The chlorhydric acid solution of tartrate of lime is not precipitated on the addition of ammonia.

Soluble in concentrated aqueous solutions of normal tartrate of potash, tartrate of potash and ammonia, and tartrate of potash and soda, separating out again for the most part when the solutions are diluted with water. (Hornemann.) A solution of 1 pt. of normal tartrate of potash in 1 pt. of water dissolves 27% of tartrate of lime at the temperature of ebullition. (Hornemann.) Soluble in cold, or better in moderately warm aqueous solutions of caustic potash or soda; a completely saturated solution obtained in this manner is partially precipitated on the addition of water, but no precipitate is produced by water in solutions containing an excess of alkali. These solutions in the fixed alkalies undergo decomposition on being heated, a basic tartrate of lime being precipitated, but this precipitate redissolves as the liquid in which it has formed becomes cold. (Osann, *Kastner's Archiv.*, 1824, **3.** 207; compare Tartrate of Lime & of Potash.)

II.) *acid.* $C_8 H_5 Ca O_{12}$ Soluble in 140 pts. of water at 16° [45° in B.'s *Lehrb.*]; more readily soluble in hot water. (Dulk.)

III.) *basic.* $3 Ca O, T$ Insoluble in water, or in hot or cold potash lye. (Osann, *Kastner's Archiv.*, 1824, **3.** 209, and 1825, **5.** 107.)

Tartrate of Lime & of Potash.

I.) *normal.*

II.) *With excess of Tartrate of Potash.* Hygroscopic. Completely soluble in boiling, but decomposed by cold water. (Hornemann.) Soluble in water. Whenever the cold aqueous solution is heated to boiling an abundant precipitate is formed, but redissolves when the liquid is allowed to cool. (Lassone, *Mémoires de l'Acad. des Sci.* (*de Paris*), 1773, p. 193 *et seq.*) This coagulation occurs as well in closed as in open vessels; up to a certain point the precipitate is more abundant in proportion as the solution is more concentrated, but when the solution is very concentrated coagulation no longer occurs; as a rule, the temperature at which precipitation takes place is higher in proportion as the solution is more concentrated, and the precipitate also dissolves again more quickly when the solution from which it was precipitated is more concentrated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** pp. 288, 291.) The precipitate consists of basic tartrate of lime. (Osann, *Kastner's Archiv.*, 1824, **3.** 204.)

III.) *acid.* Nearly insoluble in cold, decomposed by boiling water. (Martius.)

Tartrate of Lime & of Soda.

I.) $C_8 H_4 Ca Na O_{12}$ Sparingly soluble in water, more readily soluble in an aqueous solution of Rochelle salt, and still more readily in a solution of chloride of calcium. (Kaiser.)

II.) *basic.* Soluble in water. Whenever the cold aqueous solution is heated nearly to boiling an abundant precipitate is formed, but redissolves when the liquid is allowed to cool. (Lassone, *Mémoires de l'Acad. des Sci.* (*de Paris*), 1773, p. 199.) This coagulation occurs as well in closed as in open vessels; up to a certain point the precipitate is more abundant in proportion as the solution is more concentrated, but in very concentrated solutions precipitation no longer occurs. As a rule, the temperature at which precipitation takes place is higher in proportion as the solution is more concentrated, and the precipitate also dissolves again more quickly when the solution from which it was precipitated is more concentrated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** pp. 288, 291.) The precipitate consists of basic tartrate of lime. (Osann, *Kastner's Archiv.*, 1824, **3.** 204.)

Tartrate of Lithia.

I.) *normal.* $C_8 H_4 Li_2 O_{12}$ Permanent. Very readily soluble in water. (Arfvedson.)

II.) *acid.* $C_8 H_5 Li O_{12} + 3 Aq$ Still more soluble in water than the normal salt. (C. Gmelin.)

Tartrate of Lithia & of Potash. $C_8 H_4 Li K O_{12} + 2 Aq$ Permanent. (Troost.) Slightly efflorescent. Readily soluble in water. (C. Gmelin.)

Tartrate of Lithia & of Soda. $C_8 H_4 Li Na O_{12} + 4 Aq$ Superficially efflorescent. Easily soluble in water. (C. Gmelin.)

Tartrate of Magnesia.

I.) *normal.* $C_8 H_4 Mg_2 O_{12} + 8 Aq$ Soluble in 122 pts. of water at 16°. (Dulk.) [In 123.3 pts. of water at 15°. (Berzelius, *Lehrb.*).] When recently precipitated, it is soluble in aqueous solutions of chloride of ammonium, and also, though less readily, of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.)

II.) *acid.* $C_8 H_5 Mg O_{12}$ Soluble in 52 pts. of water, at 16° [in 53 pts. of water at 15°. (Berzelius, *Lehrb.*).] (Dulk.) Difficultly soluble in alcohol, which precipitates it from the aqueous solution. (Bergman, *Essays*, **1.** 450.)

III.) *basic.* $C_8 H_4 Mg_2 O_{12}, 2 Mg O + 4 Aq$ Very sparingly soluble in water, requiring 4100 pts. of water, at the ordinary temperature, to dissolve it. In ammoniacal water its solubility is the same as in pure water. Somewhat more readily soluble in an aqueous solution of chloride of ammonium. (W. Mayer, *Ann. Ch. u. Pharm.*, **101.** 169.)

Tartrate of Magnesia & of Potash.

I.) Easily soluble in water, being much more readily soluble than the normal tartrate of magnesia. (W. Mayer, *loc. cit.*)

$C_8\,H_4\,Mg\,K\,O_{12} + 8\,Aq$

II.) Small crystals. Permanent. Insoluble in water. (T. Thomson, in his *System of Chem.*, London, 1831, **2.** 794.)

$2\,C_8\,H_4\,Mg_2\,O_{12}\,;\ C_8\,H_5\,K\,O_{12} + 4\,Aq$

Tartrate of Magnesia & of Soda. Efflorescent. Easily soluble in water; being much more readily soluble than the normal tartrate of magnesia. (W. Mayer, *loc. cit.*)

$C_8\,H_4\,Mg\,Na\,O_{12} + 10\,Aq$

Tartrate of Magnesia & of Urea. Tolerably soluble in water. (Hlaziwetz.)

$Mg\,O,\ C_2\,H_4\,N_2\,O_2,\ 2\,C_8\,H_4\,O_{10}$

Tartrate *of protoxide* of Manganese. Difficultly soluble in water. Decomposed by boiling water to an insoluble basic and a soluble acid salt. (Pfaff.) Not precipitated by alkaline solutions.

$C_8\,H_4\,Mn_2\,O_{12}$

Tartrate *of sesquioxide* of Manganese.

Tartrate *of protoxide* of Manganese & of Potash. Very soluble in water. Not precipitated by caustic or carbonated alkalies. (Scheele.)

$C_8\,H_4\,Mn\,K\,O_{12}$

Tartrate of Mercur(*ic*)ammonium with *prot*Oxide of Mercury. Soluble in 1000 pts. of water; and in 455 pts. of alcohol. Insoluble in ether. Easily soluble in chlorhydric acid. Partially soluble in concentrated sulphuric acid; scarcely at all soluble in cold, almost entirely soluble in hot nitric acid. (Harff.)

$C_8\,H_4\left(N\left\{\begin{matrix}H_3\\Hg\end{matrix}\right.\right)_2 O_{12}\,;\ 6\,Hg\,O$

Tartrate of *tri*Mercur(*ic*)ammonium.

I.) Insoluble in water.

$C_8\,H_4\left(N\left\{\begin{matrix}H\\Hg_3\end{matrix}\right.\right)_2 O_{12} + 6\,Aq$

II.) "*neutral.*" Readily soluble in water either hot or cold. Insoluble in alcohol or ether. Soluble in cold concentrated sulphuric acid. (Burckhardt.)

III.) *basic.* Insoluble in water, alcohol, or ether. Easily soluble in nitric, acetic, and tartaric acids. (Burckhardt.)

Tartrate of Mercur(*ous*)ammonium.

I.) *basic, white.* Insoluble either in hot or in cold water. Soluble, especially while it is moist, in ammonia-water, and in aqueous solutions of nitrate and tartrate of ammonia. Soluble in strong acetic acid, in hot nitric acid, and in cold concentrated sulphuric acid. (Burckhardt.)

II.) *basic, black.* Insoluble in water, alcohol, or ether. Mostly soluble in nitric and acetic acids. (Harff.)

Tartrate *of dinoxide* of Mercury. Insoluble in water, alcohol, or ether. Decomposed by boiling water. Easily soluble, especially when moist, in strong acetic, and tartaric acids, in nitric acid, even dilute, and in boiling concentrated sulphuric acid, but less easily soluble in dilute sulphuric acid. (Burckhardt.) 1000 pts. of water dissolve 1.2 pts. of it; 1000 pts. of alcohol 1.3 pts. When boiled with pure water it is decomposed, an acid salt dissolving, while an insoluble basic salt remains. Soluble without decomposition in a boiling aqueous solution of tartaric acid. (Harff, in *Berzelius's Lehrb.*) When treated with aqueous solutions of the alkaline chlorides, and especially if these are hot, a certain amount of protochloride of mercury is formed and dissolves. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 179.) Soluble in a hot or warm aqueous solution of chloride of ammonium; less readily soluble in a solution of nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 97.)

$C_8\,H_4\,Hg_4\,O_{12}$

Tartrate *of protoxide* of Mercury. Insoluble in water, alcohol, or ether, even when these are boiling. (Burckhardt.)

$C_8\,H_4\,Hg_2\,O_{12}$

1000 pts. of water dissolve 3. pts. of it.
" alcohol " 2.6 "
" ether " 3.8 "

In the presence of free tartaric acid its solubility in these liquids is increased. (Harff, in *Berzelius's Lehrb.*) Only a trifle more soluble in water than the tartrate of the dinoxide, but exceedingly soluble in aqueous solutions of the alkaline chlorides, with formation of protochloride of mercury; this solution is affected still more readily when heat is applied. (Mialhe, *Ann. Ch. et Phys.*, (3.) **5.** 182.) Soluble in strong acetic and tartaric acids; and in boiling concentrated sulphuric acid, though nearly insoluble in cold sulphuric acid. Readily soluble in dilute nitric acid.

Tartrate *of dinoxide* of Mercury & of Potash. Insoluble in cold, sparingly soluble in boiling water. Readily soluble in nitric, acetic, and hot tartaric acid, from the last of which it separates out unchanged on cooling. (Burckhardt.)

$C_8\,H_4\,Hg_2\,K\,O_{12}$

Tartrate *of protoxide* of Mercury & of Potash. Nearly insoluble in cold, sparingly soluble in hot water. Insoluble in alcohol or ether. (Burckhardt.) Soluble in ether. (Harff.) Soluble in chlorhydric and nitric acids (Harff), and in warm concentrated sulphuric acid, with partial decomposition. Also soluble in an aqueous solution of normal tartrate of potash.

Tartrate of Methyl.

I.) *normal.*

$C_8\,H_4\,(C_2\,H_3)_2\,O_{12}$

II.) *acid.* *Vid.* MethylTartaric Acid.

$C_8\,H_5\,(C_2\,H_3)\,O_{12}$

Tartrate of MethylNicotin. Soluble in water.

Tartrate *of protoxide* of Molybdenum. Insoluble in water. Slightly soluble in tartaric acid. (Berzelius, *Lehrb.*)

Tartrate *of binoxide* of Molybdenum. Soluble in water. Not precipitated by caustic alkalies. (Berzelius.)

$C_8\,H_4\,Mo''\,O_{12}$

Tartrate of Molybdic Acid. Completely soluble in water, and alcohol. (Berzelius, *Lehrb.*)

Tartrate *of protoxide* of Molybdenum & of Potash. Sparingly soluble in water. Easily soluble in ammonia-water.

Tartrate *of binoxide* of Molybdenum & of Potash.

I.) *normal.* Readily soluble in water. (Berzelius.)

II.) *basic.* Sparingly soluble in water. Soluble in alkaline solutions.

Tartrate of Molybdic Acid & of Potash. Soluble in water.

Tartrate of Morphine.

I.) *normal.* Efflorescent. Soluble in water, and alcohol.

$C_8\,H_4\left(N\left\{\begin{matrix}C_{34}\,H_{18}\,O_6''\,.\,H\\H\end{matrix}\right.\right)_2 O_{12} + 6\,Aq$

II.) *acid.*
$C_8 H_5 \left(N \left\{ \begin{matrix} C_{34} H_{16} O_6'' . H \\ H \end{matrix} \right. \right) O_{12} + Aq$

Tartrate of Nickel. Almost insoluble in water, even when this is hot. (Werther.) Soluble in tartaric acid, and in the other vegetable acids. It is not precipitated when tartaric acid is added to the solution of a nickel salt. (Tupputi, *Ann. de Chim.*, 1811, **78.** 164.) Easily soluble in aqueous solutions of caustic potash and soda, and in boiling solutions of the alkaline carbonates. Not precipitated by alkaline carbonates.
$C_8 H_4 Ni_2 O_{12}$

Tartrate of Nickel & of Potash. Efflorescent. Easily soluble in water. (Wœhler.)
$C_8 H_4 Ni K O_{12}$

Tartrate of Nicotin. Readily soluble in water. (Posselt & Reimann.)

Tartrate of (α) NitrAnilin. Soluble in water.

Tartrate of (β) NitrAnilin. Soluble in water, and in an aqueous solution of caustic potash. (Arppe.)

Tartrate of Palladium. Ppt.
$C_8 H_4 Pd_2 O_{12}$

Tartrate of Picolin. Soluble in absolute alcohol. (Unverdorben.)

Tartrate of Potash.

I.) *normal.* Deliquesces in very moist air.
(Soluble Tartar.)
$C_8 H_4 K_2 O_{12}$

Soluble in 0.75 pt. of water at 2°
" 0.66 " 14°
" 0.63 " 23°
" 0.47 " 64°
(Osann.)

Soluble in 1 pt. of water at 10°, and still more soluble in hot water. (Wenzel, *Verwandtschaft*, p. 308 [T.].) Soluble in 1 pt. of cold, and in 0.5 pt. of boiling water. (Wittstein's *Handw.*) 100 pts. of water dissolve 133 pts. of it at 15°, and 296.2 pts. at 114.7°, the boiling point of the saturated aqueous solution. (Berzelius, *Lehrb.*, **3.** 168.) Soluble in 240 pts. of boiling alcohol. (Wenzel.) The aqueous solution saturated at 10° contains 33.3% of it (Eller); and at 12.5°, 61.7%. (Hassenfratz, *Ann. de Chim.*, **28.** 291.) Soluble in 1 pt. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.) 100 pts. of the saturated aqueous solution, at its boiling point (112.2°), contain 68 pts. of the dry salt; or 100 pts. of water at 112.2° dissolve 212.5 pts. of it; or 1 pt. of the dry salt is soluble in 0.471 pt. of water at 112.2°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) The saturated aqueous solution boils at 116.7°. (Faraday.)

Very sparingly soluble in boiling alcohol.

An aqueous solution of sp. gr. (at 12.5°)	Contains per-cent of the salt.	An aqueous solution of sp. gr. (at 12.5°)	Contains per-cent of the salt.
1.0050 . .	1	1.0856 . .	16
1.0102	2	1.0968	18
1.0153	3	1.1080	20
1.0212	4	1 1196	22
1.0258	5	1.1317	24
1.0311	6	1.1447	26
1.0363	7	1.1569	28
1.0417	8	1.1700	30
1.0470	9	1.1838	32
1.0525	10	1.1978	34
1.0634	12	1.2118	36
1.0744 . .	14	1.2259 . .	38
1.2400 . .	40	1.3351 . .	52
1.2547	42	1.3527	54
1.2696	44	1.3707	56
1.2861	46	1.3902	58
1.3015	48	1.4120 . .	60
1.3180 . .	50		

(Hassenfratz, *Ann. de Chim.*, **28.** 304.)

In a solution containing for 100 pts. of water, pts. of dry normal tartrate of potash,	The boiling point is elevated.	Difference.
0.0	0° . .	
26.9	1°	26.9
47.2	2°	20.3
65.0	3°	17.8
82.3	4°	17.3
100.1	5°	17.8
118.5	6°	18.4
137.3	7°	18.8
156.5	8°	19.2
176.1	9°	19.6
196.2	10°	20.1
216.8	11°	20.6
237.9	12°	21.1
259.5	13°	21.6
281.6	14°	22.1
296.2 (saturated)	14.67°	. 14.6

The point of ebullition of pure water, observed in a glass tube containing bits of zinc, having been 100.3°. (Legrand, *Ann. Ch. et Phys.*, 1835, (2.) **59.** 438.) It has a remarkable tendency to cause succussion when added to a boiling liquid. (*Ibid.*, p. 426.)

II.) *acid*, or *bi.* Permanent. Very sparingly soluble in cold water.
(Cream of Tartar. Tartar.)
$C_8 H_5 K O_{12}$

Soluble in 240 pts. of water at 10°. (Pettenkofer.)
" 234.6 " 15.5°. [T.]
" 238 " 2.7°.
" 190 " 13°
" 54 " 40°
" 20 " 68°. (Osann.)

Soluble in $\left\{ \begin{matrix} 183.67 \\ 184.71 \\ 202.10 \end{matrix} \right\}$ pts. of water at 18.75°.
" 89.0 " 25°
" 47.4 " 37.5°
" 37.8 " 50°
" 32.4 " 62.5°
" 22.0 " 75°
" 17.7 " 87.5°
" 14.3 " 100°

Or, the aqueous solution saturated at °C.	Contains percent of the salt.
18.75°	0.54 0.53 0.49
25°	1.11
37.5°	2.06
50°	2.58
62.5°	2.99
75°	4.35
87.5°	5.62
100°	6.32

(R. Brandes & Wardenburg, *Ann. der Pharm.*, 1832, **1.** pp. 12–16.) [The first of these two tables is calculated from the *experimental data* of B. & W.] Soluble in 177.6 pts. of water at 17.5°, and in 15.3 pts. of boiling water (Melandri-Contessi, from *Gazz. eclet. di Farm.*, Verona 1832, No. 15, in *Ann. der Pharm.*, 1833, **5.** 312); in 184 pts. of cold, and in 18 pts. of boiling water

(Parrish's *Pharm.*, p. 456); in 95 pts. of cold water (Vogel); in 15 pts. of boiling water (A. Vogel); in somewhat more than 14 pts. of boiling water (Wenzel, *Verwandtschaft*, p. 311 [T.]); in 160 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.) 100 pts. of the saturated aqueous solution, at its boiling point (= 101.1°), contain 9.5 pts. of the dry salt; or, 100 pts. of water at 101.1° dissolve 10.497 pts. of it; or, 1 pt. of the dry salt is soluble in 9.526 pts. of water at 101.1°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.) 100 pts. of water at 15.5° dissolve 4.6 pts. of it, and at 100° 7.0 pts. of it. (Ure's *Dict.*) The aqueous solution saturated at 10° contains 5.8% of it. (Eller, cited in *Ann. de Chim.*, **28.** 291.) The aqueous solution, when left to itself, gradually undergoes decomposition. (Berthollet, *Mem. Par.*, 1782 [T.].)

Insoluble in strong alcohol. Very soluble in concentrated mineral acids. An addition of chlorhydric acid greatly increases the solvent power of water upon it; then follow, in order, sulphuric, nitric, oxalic, phosphoric, and citric acids. Acetic acid has but little influence, and tartaric acid seems to render it less soluble. It is much more soluble in boracic acid than in water. From the solution in water acidulated with chlorhydric acid, alcohol precipitates it as such, but from the solution in dilute sulphuric acid alcohol precipitates sulphate of potash, and from an aqueous solution which contains it and nitrate of potash, the latter is precipitated on the addition of alcohol. (Destouches.) Readily soluble in aqueous solutions of caustic potash, soda, and ammonia, and of carbonate of potash.

Tartrate of Potash & of Silver. $C_8 H_4 K Ag O_{12}$ Insoluble in water. Soluble in ammonia-water. Decomposed by solutions of the fixed alkalies and their carbonates, also by solutions of the sulphates and chlorides. (*Ann. de Chim.*, **28.** 36 [T.].)

Tartrate of Potash & of Soda. (*Rochelle Salt. Seignette Salt.*) $C_8 H_4 K Na O_{12} + 8 Aq$ Permanent. The anhydrous salt dissolves in 2.62 pts. of water at 6°. (Fresenius.)

The crystallized (hydrated) salt
is soluble in 3.3 pts. of water at 3°
" 2.4 " 11°
" 1.5 " 26°
(Osann.)

1 pt. of the crystallized salt
is soluble in 1.99 pts. of water at 1.88°
" 1.22 " 12.50°
" 0.42 " 25°
" 0.30 " 37.5°

Or, 100 pts. of water at °C	Dissolve of the crystallized salt, pts.
1.88°	53
12.50°	82
25°	239
37.5	332

Or, the aqueous solution saturated at	Contains percent of the crystallized salt
1.88°	34.67
12.50°	45.76
25°	70.73
37.5°	76.84

(R. Brandes, cited in *Brandes's Archiv.*, 1824, **9.** 108, from *Buchner's Repertitorium*, **14.** pp. 449–452. In his *Jahresbericht*, **4.** 101, Berzelius gives the first table, as from *Buchner's Repert.*, **14.** pp. 451, 105, but prints 5.6°, instead of 1.88° as above.) When the salt is heated above 37.5° it begins to soften, and at 50° it melts completely in its water of crystallization. (Brandes, *Archiv.*, *loc. cit.*) Soluble in 1.714 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in Canstatt's *Jahresbericht für* 1854, p. 76.) 100 pts. of water at 15.5° dissolve 20 pts. of it. (Ure's *Dict.*) An aqueous solution saturated at 8° is of 1.254 sp. gr. (Anthon, *Ann. der Pharm.*, 1837, **24.** 211.) 100 pts. of the aqueous solution saturated at its boiling point (115.5°) contain 90 pts. of the anhydrous salt, or 100 pts. of water at 115.5° dissolve 900 pts. of it; or 1 pt. of the anhydrous salt is soluble in 0.1112 pt. of water at 115.5°. (T. Griffiths, *Quar. J. Sci.*, 1825, **18.** 90.)

Insoluble in alcohol.

It is liable to form supersaturated solutions. (Ogden.)

Tartrate of Potash & of Strontia.

I.) *normal.* Exceedingly difficultly soluble in
$C_8 H_4 K Sr O_{12} + 2 Aq$ water. (Dulk.)

II.) *basic.* Soluble in water. Whenever the cold aqueous solution is heated an abundant precipitate forms in it, which redissolves as the liquid cools unless the heating has been long continued. This coagulation occurs as well in closed as in open vessels. Up to a certain point the precipitate is more abundant in proportion as the solution is more concentrated, but when the solution is very concentrated coagulation no longer occurs. As a rule, the temperature at which precipitation takes place is higher in proportion as the solution is more concentrated, and the precipitate also dissolves again more quickly when the solution from which it was precipitated is more concentrated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** pp. 290, 291; compare *Idem*, *Kastner's Archiv.*, 1824, **3.** 204.)

Tartrate of Potash & of Tellurium. Decomposed by cold, soluble in warm water.

Tartrate of Potash & of Thoria. $C_8 H_4 K Th O_{12}$ Slowly soluble in water. It is not precipitated by alkalies. (Berzelius, *Pogg. Ann.*, 1829, **16.** 413.)

Tartrate of Potash & *of protoxide* of Tin. $C_8 H_4 K Sn O_{12}$ Easily soluble in water. No precipitate is produced in its aqueous solution by the caustic or carbonated alkalies. (Thénard; Schneider.)

Tartrate of Potash & *of protoxide* of Uranium. $4 K O, 10 Ur O, 6 C_8 H_4 O_{10} + 4 Aq$ Easily soluble in water.

Tartrate of Potash & *of binoxide* of Vanadium. Soluble in water.

Tartrate of Potash & of Zinc. $C_8 H_4 K Sr O_{12}$ Very soluble in water. No precipitate is produced in its solution by the alkalies or their carbonates. (Thénard, *Ann. de Chim.*, **38.** 35 [T.].)

Tartrate of Quinicin. The right salt is more soluble in water than the left salt.

Tartrate of Quinidin. More soluble in water than the corresponding salt of quinine.

Tartrate of Quinine.

I.) *normal.* Sparingly soluble in water.
$C_8 H_4 \left(N_2 \right\} C_{40} H_{24} O_4^{\mathrm{vi}} . H)_2 O_{12} + 2 Aq$ (Arppe.)

II.) *acid.* Easily soluble in water. (Arppe.)
$C_8 H_5 \left(N_2 \right\} C_{40} H_{24} O_4^{\mathrm{vi}} . H) O_{12} + 2 Aq$

According to Pasteur, there are two isomeric modifications of the acid salt.

a = *right.* Less soluble than *b* in water.

b = *left.* Readily soluble in water. Much more soluble in water than the right salt, especially when the water is warm. (Pasteur, *Ann. Ch. et Phys.*, 1853, (3.) **38.** 477.)

*Bi*Tartrate of Rubidium. Soluble in 84.56 pts. of water at 25°, and in 8.5 pts. of boiling water; being about 8 times less soluble in water than the corresponding salt of cesium. (Allen, *Am. J. Sci.*, 1862, **34.** pp. 372, 373.)

$C_8 H_5 Rb O_{12}$

Tartrate of Silver. Scarcely at all soluble in water. Soluble in ammonia-water.

$C_8 H_4 Ag_2 O_{12}$

It is not precipitated from solutions which contain citrate of soda. (Spiller.)

Tartrate of Soda.

I.) *normal.* Permanent.

$C_8 H_4 Na_2 O_{12} + 4 Aq$

Soluble in 5 pts. of water at the ordinary temperature. It *dissolves* in 0.5 pt. of boiling water, but the saturated solution thus obtained may be rendered very much more concentrated, and that without depositing any of the salt, by evaporating it at the temperature of boiling; thus 1 pt. of the salt may even remain dissolved in 0.0417 pt. of the boiling water; on cooling such a syrup for a moment it solidifies. (Bucholz, *Gehlen's Neues all. Journ. der Chemie*, 1805, **5.** 528.) Soluble in 1 pt. of cold water, and in all proportions in hot water. (Wenzel, *Verwandtschaft*, p. 308 [T.].)

Soluble in	2.	pts. of cold water.		(Herzog.)
"	3.46	"	at 6°	
"	2.28	"	24°	
"	1.75	"	38°	
"	1.5	"	42.5°	
				(Osann.)

The aqueous solution saturated at 10° contains 27.2% of it (Eller); and at 12.5°, 33.3%. (Hassenfratz, *Ann. de Chim.*, **28.** 291.) 100 pts. of water at 15.5° dissolve 100 pts. of it. (Ure's *Dict.*)

An aqueous solution of sp. gr. (at 12.5°).	Contains percent of the salt.
1.0034	1
1.0072	2
1.0108	3
1.0148	4
1.0190	5
1.0231	6
1.0272	7
1.0313	8
1.0355	9
1.0397	10
1.0481	12
1.0567	14
1.0655	16
1.0745	18
1.0837	20
1.1032	22
1.1153	24
1.1283	26
1.1436	28
1.1600	30
1.1801	32

(Hassenfratz, *Ann. de Chim.*, **28.** 304.)

Insoluble in absolute alcohol, either boiling or at the ordinary temperature. (Bucholz, *loc. cit.*, p. 529.)

II.) *acid.* Soluble in 12 pts. of cold water (Vogel); in 8.929 pts. of water at the ordinary temperature, and in 1.8 pts. of boiling water. Insoluble in absolute alcohol, either at the ordinary temperature or on boiling. (Bucholz, *Gehlen's Neues all. Journ. der Chemie*, 1805, **5.** 537.)

$C_8 H_5 Na O_{12} + 2 Aq$

Tartrate of Soda & of Strontia.

I.) *normal.* Soluble in 1.4 pts. of water at 15°, and in all proportions in hot water. (Dulk.)

$C_8 H_4 Na Sr O_{12} + 2 Aq$

II.) *basic.* Soluble in water. Whenever the cold aqueous solution is heated an abundant precipitate forms in it, which redissolves as the liquid cools unless the heating has been long continued. This coagulation occurs as well in closed as in open vessels. Up to a certain point the precipitate is more abundant in proportion as the solution is more concentrated; but when the solution is very concentrated coagulation no longer occurs. As a rule, the temperature at which precipitation takes place is higher in proportion as the solution is more concentrated, and the precipitate also dissolves again more quickly when the solution from which it was precipitated is more concentrated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** pp. 290, 291; compare *Idem*, *Kastner's Archiv.*, 1824, **3.** 204.)

Tartrate of Solanin. Soluble in water.

Tartrate of StannEthyl. Tolerably soluble in water.

Tartrate of StibEthylium.

I.) *normal.* Very deliquescent. Soluble in water.

II.) *acid.* Deliquescent.

Tartrate of StibMethylEthylium. Very soluble in water. (Friedlænder.)

Tartrate of StibMethylium.

I.) *normal.*

II.) *acid.* Much more soluble in water than bitartrate of potash.

Tartrate of Strontia. Soluble in 147 pts. of water at 16°, and in 320 pts. of boiling water. (Dulk.) 100 pts. of water at 100° dissolve 0.6 pt. of it. (Ure's *Dict.*) Readily soluble in aqueous solutions of chloride of ammonium, and succinate of ammonia, slowly in nitrate of ammonia. (Wittstein.) When recently precipitated it is readily soluble in aqueous solutions of chloride of ammonium and nitrate of ammonia. (Brett, *Phil. Mag.*, 1837, (3.) **10.** 96.) Soluble in aqueous solutions of caustic potash and soda, the solution coagulating on being heated, but clearing up again on cooling, unless it has previously been heated for too long a time. In any case the precipitate redissolves the more slowly in proportion as it has been longer heated. (Osann, *Gilbert's Ann. der Phys.*, 1821, **69.** 290, and *Kastner's Archiv.*, 1824, **3.** 211.)

$C_8 H_4 Sr_2 O_{12} + 8 Aq$

Tartrate of Strychnine.

I. *normal.*

a = *right.* Soluble in water.

$C_8 H_4 \left(N_2 \left\{ C_{42} H_{22} O_4^{VI} . H \right. \right)_2 O_{12} + x Aq$

b = *left.* Soluble in water.

$C_8 H_4 \left(N_2 \left\{ C_{42} H_{22} O_4^{VI} . H \right. \right)_2 O_{12} + y Aq$

II.) *acid.*

a = *right.* Soluble in water. Insoluble in absolute alcohol. (Pasteur, *Ann. Ch. et Phys.*, (3.) **38.** 475.)

$C_8 H_5 \left(N_2 \left\} C_{42} H_{22} O_4 \cdot H \right. \right) O_{12} + 6 Aq$

b = *left.* (Of same composition as the right salt.) Soluble in water. Soluble to a considerable extent in absolute alcohol, but it finally ceases to dissolve therein. (Pasteur, *loc. cit.*)

TARTRATE OF TELLURIUM. Readily soluble in water. Not precipitated by alkalies.
$C_8 H_4 Te'' O_{12}$

TARTRATE OF TELLURMETHYL. Easily soluble in water. (Wœhler & Dean.)

TARTRATE OF THORIA.

I.) *normal.* Insoluble in alcohol. Slowly and but partially soluble in ammonia-water. Soluble in tartaric acid. (Berzelius, *Pogg. Ann.*, 1829, **16**. 412.)
$C_8 H_4 Th_2 O_{12}$

II.) *acid.* Soluble in water. Decomposed by alcohol to the normal salt, which remains undissolved, and a soluble peracid salt. The aqueous solution may be mixed with ammonia-water without being precipitated. (Berzelius, *Pogg. Ann.*, 1829, **16**. 413.)

TARTRATE *of protoxide* OF TIN.

I.) *normal.* Difficultly soluble in cold, more soluble in boiling water; and still more readily in water acidulated with tartaric acid. It is not decomposed by boiling water. (Bouquet.)
$C_8 H_4 Sn_2 O_{12}$

II.) *basic.* Soluble in aqueous alkaline solutions, from which it is precipitated as a thick syrup on the addition of alcohol. (Werther.)
$C_8 H_4 Sn_2 O_{12}; 2 (Sn O, H O)$

TARTRATE *of binoxide* OF TITANIUM. Insoluble in water. Soluble in chlorhydric acid.

TARTRATE *of protoxide* OF URANIUM. Insoluble in water. Very soluble in chlorhydric acid, from which it is precipitated on the addition of ammonia. Very sparingly soluble in tartaric acid, and in an aqueous solution of bitartrate of potash.
$C_8 H_4 Ur_2 O_{12}, Ur O, + 6 Aq$

TARTRATE *of sesquioxide* OF URANIUM. Soluble in water. (Peligot, *Ann. Ch. et Phys.*, (3.) **12**. 63.) More soluble in hot than in cold water. (Berzelius, *Lehrb.*) It is precipitated by caustic alkalies. (H. Rose.)
$2 Ur_2 O_3, C_8 H_4 O_{12} + 2 Aq \,\&\, 8 Aq$

TARTRATE OF UREA.
$C_2 H_4 N_2 O_2, 2 C_8 H_4 O_{10} + Aq$

TARTRATE *of binoxide* OF VANADIUM. Very slowly soluble in cold water; more quickly soluble in ammonia-water. (Berzelius.)

TARTRATE OF VANADIC ACID.

TARTRATE OF VERATRIN. Readily soluble in water.

TARTRATE OF *tetra*VINYLIUM. Insoluble in alcohol. (Heintz & Wislicenus.)

TARTRATE OF YTTRIA.

I.) *normal.* Sparingly soluble in water. Readily soluble in alkaline solutions. Slightly soluble in free tartaric acid. (Berzelius.)
$C_8 H_4 Y_2 O_{12}$

II.) *acid.*

TARTRATE OF ZINC.

I.) *normal.* Very sparingly soluble in water, either hot or cold. (Werther.) Easily soluble in cold aqueous solutions of caustic potash and soda. (Werther.) Not precipitated by alkalies. (Thénard.)
$C_8 H_4 Zn_2 O_{12}$

II.) *basic.* Scarcely at all soluble in water.

III.) *acid.* Soluble in water, and alcohol. (John.)
$C_8 H_5 Zn O_{12}$

TARTRATE OF ZIRCONIA. Difficultly soluble in water, or in acids. Soluble in aqueous solutions of caustic potash, carbonate of ammonia, and tartaric acid. (Berzelius.)
$C_8 H_4 Zr_2 O_{12}$

TARTRELIC ACID. Deliquescent. Easily soluble in water; but the solution is decomposed when boiled. Soluble in alcohol. (Fremy.)
(*Iso Tartridic Acid. Soluble modification of Tartaric Acid.*)
$C_8 H_4 O_{10} = C_8 H_3 O_9, H O$

TARTRELATE OF AMMONIA. Alcohol precipitates it from the aqueous solution. (Fremy.)

TARTRELATE OF BARYTA. Insoluble in water or alcohol. (Laurent & Gerhardt.)
$C_8 H_3 Ba O_{10}$

TARTRELATE OF LEAD.

I.) Insoluble in water or alcohol. (Laurent & Gerhardt.)
$C_8 H_3 Pb O_{10}$

II.) $C_8 H_2 Pb_2 O_{10}$

TARTRELATE OF LIME. Completely insoluble in water. Insoluble in alcohol. (Laurent & Gerhardt.)
$C_8 H_3 Ca O_{10}$

TARTRELATE OF POTASH. Alcohol precipitates it from the aqueous solution. (Fremy.)

TARTRELATE OF SODA. Alcohol precipitates it from the aqueous solution. (Fremy.)

TARTRELATE OF STRONTIA. Insoluble in water or alcohol. (Laurent & Gerhardt.)
$C_8 H_3 Sr O_{10}$

TARTROMALAMID. *Vid.* Malamid with Tartramid.

TARTROGLYCERIC ACID. Soluble in water; partially decomposed when treated with much water, especially if this is hot. Insoluble in pure ether, but easily soluble in a mixture of alcohol and ether. The metallic tartroglycerates are soluble in water, but insoluble in alcohol. (Berzelius.)
$$C_{14} H_{12} O_{18} = \left.\begin{matrix} C_8 H_4 O_8'' \\ H . C_6 H_7 O_4 \end{matrix}\right\} O_4$$

TARTROGLYCERATE OF LIME. Permanent. Soluble in a small quantity of water, without decomposition; but a larger quantity of water decomposes it. Alcohol precipitates it from the aqueous solution. (Berzelius.)
$C_{14} H_{11} Ca O_{16}$

TARTROMETHYLIC ACID. *Vid.* MethylTartaric Acid.

TARTRONIC ACID. Soluble in water, and the solution is not decomposed on boiling.
$C_8 H_4 O_{10} = C_8 H_2 O_8, 2 H O$

TARTRONATE OF AMMONIA.

I.) *normal.* Soluble in water.

II.) *acid.* Soluble in water.

TARTRONATE OF SILVER. Ppt. (Dessaignes.)
$C_8 H_2 Ag_2 O_{10}$

TARTROVINIC ACID. *Vid.* EthylTartaric Acid.

TARTRYLIC ACID. *Vid.* Tartaric Acid.

TARTRYLPHENYLAMID. *Vid.* PhenylTartrylamid.

TAURIN. Permanent. Soluble in 15.5 pts. of water at 12°, and in less hot water. (Gmelin.) Almost insoluble in absolute alcohol. Sparingly soluble in hot spirit. Insoluble in ether. (Cloetta.) Soluble in 513 pts. of cold, somewhat more soluble in hot alcohol (of 0.835 sp. gr.). (Wittstein's *Handw.*) Slowly soluble, without decomposition, even at the boiling point, in concentrated sulphuric, chlorhydric, and nitric acids. (Gmelin.)
$C_4 H_7 N S_2 O_6$

TauroCholic Acid. (*Choleic Acid. SulphoCholeic Acid.*) $C_{52}H_{45}NS_2O_{14} = N\left\{\begin{array}{l}C_4H_5S_2O_6\,.\,O,HO\\C_{48}H_{37}O_6\\H_2\end{array}\right.$ Soluble in water. Sparingly soluble in dilute, insoluble in concentrated mineral acids. (Strecker, *Ann. Ch. et Phys.*, (3.) 22. 39.) More soluble in water than cholic acid, the aqueous solution being decomposed by evaporation. Easily soluble in alcohol. Almost insoluble in ether. Taurocholic acid dissolves fats, fatty acids, and cholesterin, in large quantities. Decomposed by boiling mineral acids, and alkaline solutions.

The alkaline taurocholates are very soluble in water, and alcohol, but are insoluble in ether.

TauroCholate of Baryta. Soluble in water, and alcohol. Insoluble in ether.

TauroCholate of Copper. Less soluble in water than in alcohol.

TauroCholate of Lead.

I.) *normal.* Appears to be soluble in water.

II.) *basic.* Ppt. Soluble in boiling water, and more freely in boiling alcohol. Soluble in an aqueous solution of acetate of lead.

TauroCholate of Lime. Soluble in water.

TauroCholate of Magnesia. Soluble in water.

TauroCholate of Potash. $C_{52}H_{44}KNS_2O_{14}$ Hygroscopic. Readily soluble in water, and alcohol. Insoluble in ether.

TauroCholate of Silver. Soluble in water.

TauroCholate of Soda. $C_{52}H_{44}NaNS_2O_{14}$ Hygroscopic. Readily soluble in water, and alcohol. Insoluble in ether.

Taurylic Acid. $C_{14}H_8O_2$ (Perhaps identical with Hydrate of Cresyl.) Soluble in ether.

Taxin (from the leaves of *Taxus baccata*). Difficultly soluble in water. Easily soluble in alcohol, and ether. Also soluble in dilute acids. Soluble in concentrated sulphuric and nitric acids. (H. Lucas.)

Tekoretin. (*Isomeric with Petrolene.*) $C_{40}H_{32}''$ Insoluble in water. Sparingly soluble in boiling, less soluble in cold alcohol. Readily soluble in ether. (Forchammer.)

Telerythrin. $C_{14}H_6O_{12}$ ("$C_{22}H_{10}O_{19}$" of Kane) Very easily soluble in water; less soluble in alcohol. Insoluble in ether. (Kane.) Soluble in ammonia-water.

TellurAmyl. $\left.\begin{array}{l}C_{10}H_{11}Te\\C_{10}H_{11}Te\end{array}\right\}$ Insoluble in water. (Wœhler & Dean.)

Telluric Acid. TeO_3 There are two allotropic modifications:

α (*anhydrous*). Completely insoluble, either in cold or in boiling water; in cold concentrated chlorhydric acid; in boiling nitric acid; or in a boiling solution of potash-lye, unless the latter be exceedingly concentrated, in which case modification β is formed.

β (*hydrated*).

a = TeO_3,HO When first treated with cold water it appears to be insoluble therein, but after long digestion in the cold, and more quickly, though still slowly, when boiled, it dissolves completely.

b = $TeO_3,3HO$ Slowly, but abundantly soluble in cold, and in almost all proportions in boiling water. Soluble in dilute, but insoluble, or very sparingly soluble, in absolute alcohol. Soluble, without decomposition, in nitric and sulphuric acids. (Berzelius, *Lehrb.*, 2. pp. 241 – 244.) Soluble in concentrated chlorhydric acid, from which it separates out again unchanged when the solution is allowed to evaporate spontaneously. (*Ibid.*, 3. 1132.) 1 pt. of the acid dissolves in 1.63 pts. of water at 19.5°, and in almost any proportion in boiling water. [*Gm.*]

Insoluble in absolute alcohol. Sparingly soluble in hydrated alcohol, the solubility being greater in proportion as the alcohol is weaker; this solution is not decomposed by boiling. (Berzelius.)

Many alkaline quadritellurates are soluble in water so long as they remain in the hydrated state, but after having been ignited they are no longer soluble in water, acids, or alkalies; most acids, even acetic, extract the base of these alkaline tellurates. The salts of the alkaline earths are but slightly soluble in water, though the acid salts are more soluble than the mono salts. All the other tellurates are nearly insoluble, but water decomposes some of them to basic and acid salts.

Tellurate of Alumina. $Al_2O_3,3TeO_3$ Ppt. Soluble in aqueous solutions of alumina salts. (Berzelius, *Lehrb.*)

Tellurate of Ammonia.

I.) *mono.* NH_4O,TeO_3 Slowly but completely soluble in cold, quickly soluble in hot water. Very sparingly soluble in an aqueous solution of chloride of ammonium. Sparingly soluble in alcohol, less easily if chloride of ammonium be present. (Berzelius.)

II.) *bi.* $NH_4O,2TeO_3$ Difficultly soluble in water, though more soluble than the potash salt.

III.) *quadri.* Very sparingly soluble in water. Insoluble in alcohol.

Tellurate of Baryta.

I.) *mono.* BaO,TeO_3 Slightly soluble in cold, more soluble in boiling water. Easily soluble, with decomposition, in nitric acid. (Berzelius, *Lehrb.*)

II.) *bi.* $BaO,2TeO_3$ Ppt. Much more soluble in water than the mono salt. By washing with water it is decomposed to the mono salt and a soluble acid salt. (Berzelius, *Lehrb.*)

III.) *quadri.* $BaO,4TeO_3$ More easily soluble in water than either the mono or bi salt. Soluble in acetic acid.

Tellurate *of sesquioxide* **of Chromium.** Ppt. Soluble in aqueous solutions of chromic salts.

Tellurate of Cobalt. CoO,TeO_3 Ppt.

Tellurate *of protoxide* **of Copper.**

I.) *mono.* CuO,TeO_3 Ppt.

II.) *bi.* Ppt.

Tellurate of Glucina. $Gl_2O_3,3TeO_3$ Resembles the yttria salt.

Tellurate *of protoxide* **of Iron.** FeO,TeO_3 Ppt.

Tellurate *of sesquioxide* **of Iron.** $Fe_2O_3,3TeO_3$ Ppt. Soluble in aqueous solutions of the sesquisalts of iron. (Berzelius, *Lehrb.*)

Tellurate of Lead.

I.) *mono.* PbO,TeO_3 Slightly soluble in water.

II.) *bi.* More soluble in water than the mono salt, but still difficultly soluble.

III.) *quadri.* Soluble to a considerable extent in water. Very sparingly soluble in dilute acetic acid. Soluble in dilute nitric acid, even after ignition. (Berzelius.)

IV.) *basic.* Not absolutely insoluble in water. (Berzelius.)

TELLURATE OF LIME.

I.) *mono.* $Ca O, Te O_3$ Somewhat soluble in hot water, but difficultly soluble in water.

TELLURATE OF LITHIA.

I.) *mono.*
II.) *bi.*
III.) *quadri.*
} Soluble in water while moist, but insoluble after having been heated to 100°.

TELLURATE OF MAGNESIA.

I.) *mono.* $Mg O, Te O_3$ More soluble in water than the baryta, lime, or strontia salt.

II.) *bi.* Still more soluble in water than the mono salt.

TELLURATE OF MANGANESE. Ppt.
$Mn O, Te O_3$

TELLURATE *of dinoxide* OF MERCURY. Ppt.
$Hg_2 O, Te O_3$

TELLURATE *of protoxide* OF MERCURY. Ppt.
$Hg O, Te O_3$

TELLURATE OF NICKEL. Ppt.
$Ni O, Te O_3$

TELLURATE OF POTASH.

I.) *mono.* $K O, Te O_3 + 5 Aq$ Hygroscopic. Easily soluble in water. Difficultly soluble in alkaline solutions. Insoluble in alcohol. (Berzelius, *Lehrb.*, 3. 175.)

II.) *bi.* $K O, 2 Te O_3$ There are two salts, one with the α, the other with β telluric acid:

α = *Insoluble.* Insoluble in boiling water, or in acids, or in alkaline solutions.

β = $K O, 2 Te O_3 + 4 Aq$ Difficultly soluble in cold, very much more soluble in boiling water. Less soluble in water than the corresponding salt of ammonia. Insoluble in a boiling aqueous solution of nitrate of potash.

III.) *quadri.*
$K O, 4 Te O_3$

α = *Insoluble.* (*Yellow.*) Insoluble in water, or in dilute acids, or in tolerably concentrated sulphuric, nitric, or chlorhydric acid, or an aqueous solution of caustic potash, at the ordinary temperature. By long-continued boiling with nitric acid it is dissolved, being transformed into the β modification.

β = $K O, 4 Te O_3 + 4 Aq$ Not completely insoluble in water. Soluble in acids.

TELLURATE OF SILVER.

I.) *mono.* $Ag O, Te O_3$ Decomposed by water, with formation of an insoluble basic, and a soluble acid salt. (Berzelius.) Soluble in ammonia-water.

II.) *bi.* Ppt.
$Ag O, 2 Te O_3$

III.) *quadri.* Ppt.
$Ag O, 4 Te O_3$

IV.) *sesqui.* Insoluble in boiling water.
$3 Ag O, 2 Te O_3$

V.) *tri.* Soluble in ammonia-water.
$3 Ag O, Te O_3$

TELLURATE OF SODA.

I.) *mono.* $Na O, Te O_3 + 2 Aq$ When telluric acid is saturated with a solution of caustic soda it dissolves therein, but if the alkali is added in excess the solution deposits granular monotellurate of soda, especially on warming. As thus obtained, the salt is exceedingly difficultly soluble, either in cold or hot water. What remains in the alkaline solution may be precipitated, in the granular state, with alcohol. If it be boiled with renewed portions of water it dissolves, and remains dissolved so long as no excess of soda is present. When this solution is evaporated on the water-bath nothing separates out, and at last a soft gum-like mass remains, which is soluble in water, unless it be completely dried, in which case it will be as difficultly soluble as at first. When the salt is heated until its water of crystallization has been driven off, which requires a heat approaching to ignition, it passes into another allotropic condition, and is now insoluble, either in cold or in hot water, though it dissolves in hot dilute nitric acid. (Berzelius, *Lehrb.*, 3. 256.)

II.) *bi.* $Na O, 2 Te O_3 + 4 Aq$ Slowly but completely soluble in water. Difficultly soluble in an aqueous solution of acetate of soda. Insoluble in alcohol. (Berzelius, *Lehrb.*, 3. 257.)

III.) *quadri.* $Na O, 4 Te O_3 + x Aq$ There are two modifications of the hydrated salt, one slowly soluble in cold water, the other insoluble, even in boiling water. When the aqueous solution of the soluble modification is evaporated to dryness a portion of the insoluble modification is formed. On heating strongly either of these hydrates an anhydrous (α) yellow quadritellurate is obtained, which is as insoluble as the corresponding potash salt. (Berzelius, *Lehrb.*, 3. 257.)

TELLURATE OF STRONTIA.

I.) *mono.* $Sr O, Te O_3$ Sparingly soluble in water. (Berzelius.)

TELLURATE OF THORIA. $Th O, Te O_3$ Insoluble in water, or in aqueous solutions of the thorium salts. (Berzelius.)

TELLURATE *of sesquioxide* OF URANIUM. $Ur_2 O_3, Te O_3$ Insoluble in water, or in an aqueous solution of nitrate of sesquioxide of uranium.

TELLURATE OF YTTRIA. $Y O, Te O_3$ Insoluble in water, or in aqueous solutions of yttria salts. (Berzelius, *Lehrb.*)

TELLURATE OF ZIRCONIA. $Zr_2 O_3, 3 Te O_3$ Ppt. Soluble in aqueous solutions of the zirconium salts.

TELLURETHYL. $C_4 H_5 Te$ or $\left.\begin{matrix} C_4 H_5 Te \\ C_4 H_5 Te \end{matrix}\right\}$ Nearly insoluble in water. Soluble in alcohol. (Wœhler.)

TELLURHYDRIC ACID. (*Hydrotelluric Acid.*) $H Te$ Soluble in water; the solution decomposing when exposed to the air.

Among the metallic tellurides, those only are soluble in water which correspond to the soluble oxides; thus the tellurides of potassium, sodium, lithium, barium, strontium, calcium, and magnesium, are soluble in water, while all the others are insoluble. (Persoz, *Chim. Moléc.*, p. 463.)

TELLURIDE OF ALUMINUM. Decomposed by water.

TELLURIDE OF AMYL. *Vid.* TellurAmyl.

TELLURIDE OF BISMUTH.

TELLURIDE OF ETHYL.

I.) *mono.* *Vid.* TellurEthyl.

II.) *bi.*
$C_4 H_5 Te_2$

Telluride of Glucinum. Decomposed by water.

Telluride of Gold & of Lead. Soluble, with decomposition, in nitric acid.

Telluride of Gold & of Silver.

I.) $5\,Ag\,Te\,;\ Au\,Te$

II.) Soluble, with decomposition, in aqua-regia.
$Ag\,Te_4\,;\ Au\,Te_3$

III.) $Ag\,Te_3\,;\ Au\,Te_2$

Telluride of Iron. Soluble, with decomposition, in chlorhydric acid.

Telluride of Lead.
$Pb\,Te$

Telluride of Methyl. *Vid.* TellurMethyl.

Telluride of Potassium. Soluble in water, the solution undergoing decomposition when exposed to the air. Decomposed by acids.

Telluride of Silver. Slowly soluble in cold, quickly soluble in hot nitric acid. (G. Rose.)
$Ag\,Te$

Telluride of Sodium.

Telluride of TellurEthyl.
$C_4\,H_5\,Te,\ Te$

Telluride of Zinc. Insoluble in strong sulphuric or chlorhydric acid.

Tellurous Acid. *Vid. bin*Oxide of Tellurium.

The alkaline tellurites are soluble in water; the others are either difficultly soluble or insoluble therein, but dissolve in chlorhydric acid.

Tellurite of Alumina. Ppt. Insoluble in aqueous solutions of alumina salts. (Berzelius, *Lehrb.*)
$Al_2\,O_3,\ 3\,Te\,O_2$

Tellurite of Ammonia.

I.) *acid.* Soluble in water, but the solution undergoes decomposition when evaporated. Insoluble in alcohol, and, after having been washed with alcohol, it is no longer soluble in water.

II.) *quadri.* Nearly insoluble in an aqueous solution of chloride of ammonium. Insoluble in alcohol. (Berzelius.)
$N\,H_4\,O,\ 4\,Te\,O_2 + 4\,Aq$

Tellurite of Baryta.

I.) *mono.* As prepared in the moist way, it is a precipitate, sparingly soluble in water. But when prepared in the dry way, boiling water dissolves only a very slight amount of it. (Berzelius, *Lehrb.*)
$Ba\,O,\ Te\,O_2$

II.) *quadri.*
$Ba\,O,\ 4\,Te\,O_2$

Tellurite *of sesquioxide* **of Chromium.** Ppt. Soluble in aqueous solutions of the chromic salts.

Tellurite of Cobalt.
$Co\,O,\ Te\,O_2$

Tellurite of Copper. Ppt.
$Cu\,O,\ Te\,O_2$

Tellurite of Glucina. Ppt. Resembles the yttria compound.
$Gl_2\,O_3,\ 3\,Te\,O_2$

Tellurite of Iodide of Tellurium. Unacted upon by water.

Tellurite *of protoxide* **of Iron.** Ppt.
$Fe\,O,\ Te\,O_2$

Tellurite *of sesquioxide* **of Iron.** Ppt.
$Fe_2\,O_3,\ 3\,Te\,O_2$

Tellurite of Lead.

I.) *mono.* Easily soluble in acids.
$Pb\,O,\ Te\,O_2$

II.) *basic.* Not absolutely insoluble in water. (Berzelius.)

Tellurite of Lime.

I.) *mono.* Very sparingly soluble in cold, more soluble in boiling water.
$Ca\,O,\ Te\,O_2$

II.) *bi.*
$Ca\,O,\ 2\,Te\,O_2$

III.) *quadri.*
$Ca\,O,\ 4\,Te\,O_2$

Tellurite of Lithia.

I.) *mono.* Soluble in water.
$Li\,O,\ Te\,O_2$

II.) *bi.* Decomposed by cold, but is completely soluble in hot water.
$Li\,O,\ 2\,Te\,O_2$

III.) *quadri.* Behaves towards water like the potash and soda salts.
$Li\,O,\ 4\,Te\,O_2$

Tellurite of Magnesia.

I.) Much more soluble in water than the lime, baryta, or strontia salt.
$Mg\,O,\ Te\,O_2$

II.) *quadri.* Less soluble than No. I.

Tellurite of Manganese. Ppt.
$Mn\,O,\ Te\,O_2$

Tellurite *of dinoxide* **of Mercury.** Ppt.
$Hg_2\,O,\ Te\,O_2$

Tellurite *of protoxide* **of Mercury.** Ppt.
$Hg\,O,\ Te\,O_2$

Tellurite of Nickel. Ppt.
$Ni\,O,\ Te\,O_2$

Tellurite of Potash.

I.) *mono.* Sparingly soluble in cold, more quickly soluble in hot water. (Berzelius.)
$K\,O,\ Te\,O_2$

II.) *bi.* Partially soluble in cold water; soluble, with decomposition, in hot water. (Berzelius.)
$K\,O,\ 2\,Te\,O_2$

III.) *quadri.* Decomposed by water.
$K\,O,\ 4\,Te\,O_2$

Tellurite of Silver.

I.) *mono.* Soluble in ammonia-water.
$Ag\,O,\ Te\,O_2$

II.) *bi.* Insoluble in water. Soluble in nitric acid. (G. Rose.)
$Ag\,O,\ 2\,Te\,O_2$

Tellurite of Soda.

I.) *mono.* Slowly, but completely soluble in cold, and more quickly in warm water. It does not separate from the hot solution on cooling. Insoluble in alcohol. (Berzelius, *Lehrb.*)
$Na\,O,\ Te\,O_2$

II.) *bi.* Decomposed by water, like the potash salt. (Berzelius.)
$Na\,O,\ 2\,Te\,O_2$

III.) *quadri.* Soluble in boiling water.
$Na\,O,\ 4\,Te\,O_2$

Tellurite of Strontia. Similar to the baryta salt.

Tellurite of Thoria. Insoluble in water, or in aqueous solutions of thorium salts. (Berzelius.)
$Th\,O,\ Te\,O_2$

Tellurite *of protoxide* **of Tin.** Is precipitated, even when in the presence of 60000 pts. of water. (Fischer.)

Tellurite *of sesquioxide* **of Uranium.** Insoluble in water.
$Ur_2\,O_3,\ Te\,O_2$

Tellurite of Yttria. Insoluble in water, or in aqueous solutions of yttrium salts. (Berzelius, *Lehrb.*)
$Y\,O,\ Te\,O_2$

Tellurite of Zinc.
$Zn\,O,\ Te\,O_2$

Tellurite of Zirconia. Ppt.
$Zr_2\,O_3,\ 3\,Te\,O_2$

Tellurium. Insoluble in water. Soluble, without oxidation, in concentrated sulphuric acid, from which it is precipitated on the
Te

addition of water. Decomposed by concentrated nitric acid, aqua-regia, and hot concentrated sulphuric acid.

According to Hartung-Schwarzkopf (from *Arch. der Pharm.*, **108.** 150, in *Ann. Min.*, (4.) **19.** 345), amorphous tellurium, prepared by reducing telluric acid with sulphurous acid, is not acted upon by concentrated nitric acid, even after prolonged boiling, contrary to the statements of many chemical treatises.

TellurMethyl. Not miscible with water. (Wœhler & Dean, *Ann. Ch. u. Pharm.*, **93.** 233.)
$\left.\begin{matrix} C_2 H_3 Te \\ C_2 H_3 Te \end{matrix}\right\}$

TerChloride (&c.) of *X*. See under Chloride (&c.) of *X*, as *ter*Chloride of *X*, and the like.

Terebic Acid. Sparingly soluble in cold, much more soluble in boiling water. Very readily soluble in alcohol, and ether. (Rabourdin.) Soluble, without alteration, in concentrated nitric acid. (Bromeis.)
(*Terebilic Acid. Terpenthic Acid.*)
$C_{14} H_{10} O_8 = C_{14} H_8 O_6, 2 H O$

The terebates of the alkalies and alkaline earths are very soluble in water.

Terebate of Amyl.
I.) *acid.*
$C_{24} H_{20} O_8 = C_{14} H_9 (C_{10} H_{11}) O_8$

Terebate of Ethyl.
I.) *acid.* Sparingly soluble in water. (Caillot.)
$C_{18} H_{14} O_8 = C_{14} H_9 (C_4 H_5) O_8$

Terebate *of sesquioxide* of Iron. Difficultly soluble in water; being the least soluble of the terebates. (Rabourdin.)

Terebate of Lead.
I.) *acid.* Very soluble in water.
$C_{14} H_9 Pb O_8$
II.) *basic.* Soluble in water.

Terebate of Methyl.
I.) *acid.* Sparingly soluble in water. (Caillot.)
$C_{16} H_{12} O_8 = C_{14} H_9 (C_2 H_3) O_8$

Terebate of Silver.
I.) *normal.*
$C_{14} H_8 Ag_2 O_8 + 2 Aq$
II.) *acid.* Sparingly soluble in cold, much more soluble in hot water.
$C_{14} H_9 Ag O_8$

"**Terebene**" of (Soubeiran). *Vid.* Camphilene.

Terebene. Insoluble in water, and does not combine therewith, even after half a year's contact. Soluble in alcohol, and ether. (Deville.)
(*Isomeric with Oil of Turpentine.*)
$C_{20} H_{16}$

Terebentic Acid (?). Soluble in alcohol, and the solution is rendered turbid by water. (Weppen.) Its salts are soluble in alcohol.
$C_{18} H_{14} O_{10}$ (?)

Terebentate of Lead. Insoluble in water. Soluble in alcohol. (Weppen.)

Terebentilic Acid. Nearly insoluble in cold, more readily soluble in boiling water. Very easily soluble in alcohol. Readily soluble in ether. (Personne.)
$C_{16} H_{10} O_4 = C_{16} H_9 O_3, H O$

Terebentilate of Ethyl.
$C_{20} H_{14} O_4 = C_{16} H_9 (C_4 H_5) O_4$

Terebentilate of Lead.

Terebentilate of Lime.
$C_{16} H_9 Ca O_4$

Terebentilate of Silver. Sparingly soluble in boiling water, separating out again as the solution cools.
$C_{16} H_9 Ag O_4$

Terebenzic Acid. Soluble in boiling, much less soluble in cold water. Largely soluble in alcohol, and ether. The terebenzates are usually equally soluble with the corresponding benzoates. (Caillot, *Ann. Ch. et Phys.*, (3.) **21.** pp. 31, 33.)
$C_{28} H_{14} O_8 = C_{28} H_{12} O_6, 2 H O$

Terebenzate of Baryta. Very sparingly soluble in water. (Caillot.)

Terebenzate of Silver.

Terebilene. Combines with chlorhydric acid, forming a liquid compound. (Soubeiran & Capitaine.)
("*Peucyl*" (*of Blanchet & Sell*).)
Isomeric with Oil of Turpentine.)
$O_{20} H_{16}$

Terebilic Acid. *Vid.* Terebic Acid.

Terechrysic Acid. Soluble in all proportions in water, alcohol, and ether. Most of its salts are soluble in water. (Caillot, *Ann. Ch. et Phys.*, (3.) **21.** 34.)
$C_{12} H_8 O_{10} = C_{12} H_6 O_8, 2 H O$

Terechrysate of Baryta. Soluble in water.

Terechrysate of Ethyl.

Terechrysate of Lead. Somewhat soluble in hot, less soluble in cold water.

TerePhtalic Acid. Insoluble in water, alcohol, or ether. Soluble in alkaline solutions, with combination. (Caillot, *Ann. Ch. et Phys.*, (3.) **21.** 29.)
$C_{16} H_6 O_8 = C_{16} H_4 O_6, 2 H O$

TerePhtalate of Ammonia. Soluble in water.

TerePhtalate of Baryta. Insoluble, or very sparingly soluble, in water. (Caillot.)

TerePhtalate of Silver.

Teretinic Acid. Insoluble in water. Soluble in alcohol, from which it is precipitated on the addition of water.
(*Terpentinic Acid.*)
$C_{18} H_4 O_{10} = C_{18} H_{13} O_9, H O$

Terpenthic Acid. *Vid.* Terebic Acid.

Terpin. *Vid.* Hydrate of Turpentine-Oil.

Terpinol.
(*MonoHydrate of Oil of Turpentine*(of Berthelot and of Gerhardt))
$C_{40} H_{34} O_2 = \left.\begin{matrix} C_{40} H_{33} \\ H \end{matrix}\right\} O_2$

TetraSulphate (&c.) of *X*. See under Sulphate (&c.) of *X*, as *tetra*Sulphate of *X*, and the like.

Tetryl. *Vid.* Butyl.

***Di*Tetryl.** *Vid.* Butylene.

Tetrylamin. } *Vid.* Butylamin.
Tetrylammonia. }

TetryAmyl. *Vid.* ButylAmyl.

Tetrylene. *Vid.* Butylene.

Tetrylene*Chloré*. *Vid.* ChloroButylene.

Tetrylic Alcohol. *Vid.* Hydrate of Butyl.

Tetrylic Urethane. *Vid.* Carbamate of Butyl.

TetrylSulphuric Acid. *Vid.* ButylSulphuric Acid.

TetrylSulphydric Acid. *Vid.* ButylSulphydric Acid.

Thalleiochin. Soluble in alcohol. Also in acids, with combination. (Brandes & Leber.)
$C_{15} H_{10} N O_5$

Thebain. *(ParaMorphin.)* $C_{38}H_{21}NO_6 = N\left\{\begin{matrix}C_{38}H_{20}O_6''\\H\end{matrix}\right.$ Insoluble, or but sparingly soluble, in water. Readily soluble in alcohol, and ether, especially when these are hot. Insoluble in strong aqueous solutions of caustic ammonia, or potash, but soluble in a dilute solution of caustic potash. Easily soluble in acids. Soluble in cold concentrated sulphuric acid, but the solution is decomposed on boiling.

Thein. *Vid.* Caffein.

Theobromin. $C_{14}H_8N_4O_4 = N_3\left\{\begin{matrix}C_2O_2''\\C_6O_2''\\(C_2H_3)_2\\C_2N\\H_2\end{matrix}\right.$ Sparingly soluble in boiling water; and still less soluble in alcohol, and ether. (Woskresensky.) Permanent.

Soluble in 1600 pts. of cold water.
" 55 " hot "
" 1460 " cold alcohol.
" 47 " boiling "
" 17000 " cold ether.
" 600 " boiling "

Easily soluble in ammonia-water, acetic acid, and aqueous solutions of the caustic alkalies, especially when these liquids are warm. (Wittstein's *Handw.*) Soluble in 960 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.) Soluble in a boiling aqueous solution of caustic baryta, from which it separates again as the solution cools. (Parrish's *Pharm.*, p. 399.)

Therythrin. Scarcely at all soluble in water. Easily soluble in alcohol, acetone, and bisulphide of carbon. Sparingly soluble in ether. (Zeise.)

ThiAcetic Acid(Anhydrous). *Vid.* Sulphide of Acetyl.

ThiAcetic Acid. *(Sulphydrate of Acetyl. AcetylSulphydric Acid.)* $C_4H_4S_2O_2 = \left.\begin{matrix}C_4H_3O_2\\H\end{matrix}\right\}S_2$ Soluble in water, especially when this is warm; still more readily soluble in alcohol, and ether. The salts of thiacetic acid are all more or less soluble in water, and alcohol.

ThiAcetate of Ammonium. Very deliquescent.

ThiAcetate of Barium. $C_4H_3BaO_2S_2 + 3\,Aq$ Soluble in water, and alcohol.

ThiAcetate of Copper(Cu O). Insoluble in water. (Ulrich.)

ThiAcetate of Ethyl. $C_4H_3(C_4H_5)O_2S_2$ Insoluble in water. (Kekulé, *Ann. Ch. u. Pharm.*, **90.** 313.)

ThiAcetate *of sesquioxide* of Iron. Soluble in water.

ThiAcetate of Lead. $C_4H_3PbO_2S_2$ Sparingly soluble in cold water. Somewhat more soluble in warm water, and in alcohol. (Kekulé, *loc. cit.*, p. 311.)

ThiAcetate of Lime. $C_4H_3CaO_2S_2 + 2\,Aq$ Soluble in water.

ThiAcetate of Magnesia. Deliquescent. Soluble in water.

ThiAcetate *of protoxide* of Mercury. Ppt.

ThiAcetate of Potash. $C_4H_3KS_2O_2$ Readily soluble in water, and alcohol. (Ulrich.)

ThiAcetate of Silver. Insoluble in water.

ThiAcetate of Sodium. $C_4H_3NaS_2O_2$ Very soluble in water, and alcohol. (Ulrich.)

ThiAcetate of Strontium. $C_4H_3SrS_2O_2 + 2\,Aq$ Soluble in water.

ThiAcetate of Zinc. Soluble in water.

ThiAcetonin. *("Probably identical with Zeise's Akcethin.")* $C_{18}H_{19}NS_4$? Rather difficultly soluble in water. Easily soluble in alcohol, ether, acetone, and dilute acids. (Stædeler.)

Thiaethaldin. $C_{16}H_{17}NS_4$ Easily soluble in ether. Soluble in chlorhydric acid, with combination. (Flueckiger.)

Thialdin. $C_{12}H_{13}NS_4 = N\left\{C_{12}H_{13}S_4'''\right.$ Very sparingly soluble in water. Very soluble in alcohol, and still more soluble in ether. (Liebig & Wœhler.)

Thialoel. *Vid. bi*Sulphide of Ethyl.

ThiAnisiol. *Vid.* Hydride of SulphAnisyl.

ThianylAnisamid. *Vid.* PhenylAnisamid.

Thimethaldin. $C_{14}H_{15}NS_4$

ThioBenzaldin. Soluble in boiling ether. $C_{42}H_{19}NS_4 = N\left\{\begin{matrix}(C_{14}H_7S_2)_2\\C_{14}H_5\end{matrix}\right.$; or $N\left\{C_{42}H_{19}S_4'''\right.$

***Bi*ThioBenzolic Acid.** *(PhenylbiSulphobiamic Acid.)* $C_{12}H_8N_2S_4O_{12}$ Not isolated. Its salts are readily soluble in water.

***Bi*ThioBenzolate of Ammonium.** $C_{12}H_6(NH_4)_2N_2S_4O_{12}$ Extremely soluble in water, and spirit. Very sparingly soluble in absolute alcohol. Insoluble in ether. Unacted upon by concentrated chlorhydric or cold sulphuric acid. (Hilkenkamp, *Ann. Ch. u. Pharm.*, **95.** 95.)

***Bi*ThioBenzolate of Barium.** $C_{12}H_6Ba_2N_2S_4O_{12}$ Soluble in water. Insoluble in alcohol or ether. (Hilkenkamp, *loc. cit.*)

ThioButyric Acid. *Vid.* Sulphydrate of Butyryl.

ThioCinnol. *(Sulphydrate of Cinnamoyl.)* $C_{18}H_8S_2 = \left.\begin{matrix}C_{18}H_7\\H\end{matrix}\right\}S_2$ Sparingly soluble in alcohol. (Cahours.)

ThioCyanhydric Acid. *Vid.* HydroThioCyanic Acid.

ThioFormic Acid. *(ThioFormylic Acid. Sulphide of Formyl.)* $C_2H_2S_2O_2 = \left.\begin{matrix}C_2HO_2\\H\end{matrix}\right\}S_2$ Insoluble in water. Nearly insoluble in cold, tolerably soluble in boiling alcohol, and ether. Soluble in formic acid. Sparingly soluble in warm concentrated acetic acid, less soluble in cold concentrated acetic acid. Boiling chlorhydric acid has no action upon it; nitric acid decomposes it; concentrated sulphuric acid, when gently warmed, dissolves it, with decomposition. Insoluble in an aqueous solution of sulphide of ammonium, either cold or boiling. Scarcely at all attacked by a boiling aqueous solution of caustic potash. (Limpricht, *Ann. Ch. u. Pharm.*, **97.** 361.)

ThioFucusol. *(FucusolSulphuré.)* Resembles ThioFurfurol.

ThioFurfurol. *(ThioFurfol. FurfurylSulfuré. Sulphide of Furfuryl.)* $C_{10}H_4O_2S_2 = \left.C_{10}H_4O_2''\right\}S_2$ Insoluble in cold, sparingly soluble in boiling water. Tolerably soluble in alcohol, especially when this is hot. Soluble in ether. The alcoholic solution slowly decomposes when exposed to the air. (Cahours, *Ann. Ch. et Phys.*, (3) **24.** 284.)

Thiomelanic Acid. Insoluble in water, or in alkaline solutions.

$C_{30}H_{24}S_3O_{20}, 2HO$?

Thiomelanate of Ammonia. Insoluble in water.

Thiomelanate of Baryta. Insoluble in water.

Thiomelanate of Lead. Insoluble in water.

Thiomelanate of Potash. Insoluble in water. A small quantity of this salt is retained in suspension by water, but is deposited on the addition of chloride of sodium. (Erdmann.)

Thionamid. Soluble in water, and alcohol.

(Sulphamid.)
NH_2SO_2

ThioNaphthalinic Acid. *Vid.* *bi*Sulpho-Naphthalinic Acid.

ThioNaphthamic Acid. Not isolated. Its salts are all soluble in water. (Piria.)

(Isomeric with Naphthionic Acid.)
$C_{20}H_9NS_2O_6$

ThioNaphthamate of Ammonia. Very soluble in water, and alcohol. (Piria, *Ann. Ch. et Phys.*, (3.) **31.** 244.)

$C_{20}H_8(NH_4)NS_2O_6$

ThioNaphthamate of Baryta. Soluble in water. (Piria.)

$C_{20}H_8BaNS_2O_6 + 3Aq$

ThioNaphthamate of Lead. Very sparingly soluble in water. Almost insoluble in alcohol. (Piria.)

ThioNaphthamate of Lime. Very soluble in water. (Piria.)

ThioNaphthamate of Magnesia. Very soluble in water. (Piria.)

ThioNaphthamate of Potash. Very soluble in pure water. Very sparingly soluble in aqueous solutions of caustic and carbonated potash. Scarcely at all soluble in alcohol. (Piria.)

$C_{20}H_8KNS_2O_6$

ThioNaphthamate of Soda. Sparingly soluble in cold, very soluble in boiling water. Very sparingly soluble in an aqueous solution of carbonate of soda. (Piria.)

***Di*Thionic Acid.** *Vid.* HypoSulphuric Acid.

***Tri*Thionic Acid.** Known only in solution; its aqueous solution gradually decomposes, less rapidly when it is dilute.

(Sulphuretted Hyposulphuric Acid.
MonoSulhyposulphuric Acid.
Acide Hyposulphurique Monosulfuré.)
S_3O_5

The aqueous solutions of all the thionic acids appear to be considerably more stable when they contain acids. On the other hand, they are all, with the exception of dithionic acid, easily decomposed by weak alkaline solutions. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **28.** 454.)

***Tri*Thionate of Baryta.** Sparingly soluble in water, less soluble in alcohol. Easily soluble in nitric acid. (Langlois.)

$BaO, S_3O_5 + 2Aq$

***Tri*Thionate *of protoxide* of Iron.** Soluble in water. (Plessy, *loc. cit.*)

***Tri*Thionate of Lead.**

***Tri*Thionate of Lime.** Hygroscopic. Soluble in water. (Baumann; Plessy, *loc. cit.*)

CaO, S_3O_5

***Tri*Thionate of Manganese.** Soluble in water. (Plessy, *loc. cit.*)

***Tri*Thionate of Nickel.** Soluble in water. (Plessy, *loc. cit.*)

***Tri*Thionate of Potash.** Permanent. Soluble in water. (Langlois.) Easily soluble in water, especially when this is warmed to 50° @ 60°, but the solution is decomposed on boiling. Soluble in hot alcohol, from which it separates as the solution cools. (Plessy, *Ann. Ch. et Phys.*, (3.) **11.** 185.)

KO, S_3O_5

***Tri*Thionate of Silver.** Ppt.

***Tri*Thionate of Soda.**

NaO, S_3O_5

***Tri*Thionate of Zinc.** Soluble in water. (Fordos & Gélis.)

***Tetra*Thionic Acid.** Soluble in water, and the aqueous solution is about as stable as that of hyposulphuric acid, it being possible to obtain it in a tolerably concentrated state. When largely diluted the solution may be boiled without suffering decomposition, but as the solution becomes more concentrated decomposition ensues. It is not acted upon by dilute chlorhydric or sulphuric acid, but is decomposed by dilute nitric acid. Most of its salts are soluble in water, and less soluble in alcohol; but their aqueous solutions slowly decompose when exposed to the air; on heating them the decomposition is rapid. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **6.** pp. 493, 492.)

(BiSulphuretted Hyposulphuric Acid.
BiSulhyposulphuric Acid.
Acide Hyposulfurique bisulfuré.)
S_4O_5 & $+ HO$

***Tetra*Thionate of Baryta.** Permanent. Very soluble in water, though less soluble than iodide of barium. Sparingly soluble in alcohol. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **6.** pp. 489, 490.) Easily soluble in water. Insoluble in strong alcohol. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **22.** 70.)

$BaO, S_4O_5 + 2Aq$

***Tetra*Thionate of Copper.** Soluble in water. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **6.** 492.)

***Tetra*Thionate of Iron.** Soluble in water. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **6.** 492.) The aqueous solution is decomposed by evaporation. Alcohol does not precipitate the salt from the aqueous solution. (Berzelius's *Lehrb.*, **3.** 601.)

FeO, S_4O_5

***Tetra*Thionate of Lead.** Soluble in water. Insoluble in alcohol.

$PbO, S_4O_5 + 2Aq$

***Tetra*Thionate *of dinoxide* of Mercury.** Ppt.

***Tetra*Thionate of Potash.** Soluble in hot water; much less soluble in alcohol. (Kessler.)

KO, S_4O_5

***Tetra*Thionate of Silver.** Ppt.

***Tetra*Thionate of Soda.** Soluble in water. Less insoluble in alcohol than the potash salt. (Kessler.)

NaO, S_4O_5

***Tetra*Thionate of Strontia.** More soluble in alcohol than the baryta salt. (Kessler.)

$SrO, S_4O_5 + 6Aq$

***Tetra*Thionate *of protoxide* of Tin.**

***Tetra*Thionate of Zinc.** Soluble in water. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **6.** 492.)

***Penta*Thionic Acid.** Soluble in water, but the solution is very instable; its aqueous solution, or that of any of the pentathionates, being only preserved with difficulty (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **28.** 452), but an alcoholic solution of pentathionic acid can be preserved

(TerSulphypo Sulphuric Acid.
TerSulphuretted HypoSulphuric Acid.)
S_5O_5, HO

undecomposed for months. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **22.** 80.) All the pentathionates are soluble in water, alcohol, and ether. (Wackenroder, *Ann. Ch. et Phys.*, (3.) **20.** 151.) Many of them are known only in solution.

*Penta***Thionate of Baryta.** $Ba\,O, S_5\,O_5 + 2\,Aq$ Very soluble in water. Soluble in alcohol, and ether. The aqueous solution begins to decompose at 25°. (Wackenroder, *Ann. Ch. et Phys.*, (3.) **20.** 151.) More soluble in water, and more alterable than tetrathionate of baryta. The aqueous solution soon decomposes on standing, and more rapidly when boiled. Alcohol, and ether precipitate it from the aqueous solution. (Fordos & Gélis, *Ann. Ch. et Phys.*, (3.) **22.** pp. 78, 80.) Soluble in water. Very sparingly soluble in absolute alcohol; more soluble in dilute spirit. (Sobrero & Selmi, *Ann. Ch. et Phys.*, (3.) **28.** 211.)

*Penta***Thionate** *of protoxide* **of Iron.** $Fe\,O, S_5\,O_5$ Soluble in water, the solution undergoing decomposition when evaporated.

*Penta***Thionate of Lead.** Soluble in water.

*Penta***Thionate of Potash.** ?

*Penta***Thionate of Silver.** Ppt.

*Penta***Thionate of Soda.** $Na\,O, S_5\,O_5$ Known only in solution.

Thionessal. $C_{52}\,H_{18}\,S_2 = \left.\begin{matrix} C_{26}\,H_9 \\ C_{26}\,H_9 \end{matrix}\right\}S_2$ Almost insoluble in boiling alcohol. Difficultly soluble in boiling ether. Its best solvent is hot naphtha, from which it separates on cooling. (Laurent.)

*Di***Thionous Acid.** *Vid.* HypoSulphurous Acid.

ThionUric Acid. $C_8\,H_5\,N_3\,S_2\,O_{12} = N_3\left\{\begin{matrix} C_2\,O_2{}'' \\ C_6\,O_4{}'' \\ S_2\,O_4{}'' \\ H_3 \end{matrix}\right., 2\,H\,O$ Permanent. Readily soluble in water, the solution being decomposed by boiling. The alkaline thionurates are soluble in water, but those of the alkaline earths and metals are difficultly soluble, or insoluble, therein, though easily soluble in dilute acids.

Thionurate of Ammonia.
I.) *normal.* $C_8\,H_3\,(N\,H_4)_2\,N_3\,S_2\,O_{12} + 2\,Aq$ Sparingly soluble in cold, very soluble in warm water.
II.) *acid.* $C_8\,H_4\,(N\,H_4)\,N_3\,S_2\,O_{12}$ Soluble in water.

Thionurate of Baryta. $C_8\,H_3\,Ba_2\,N_3\,S_2\,O_{12} + 2\,Aq$ Very soluble in chlorhydric acid.

Thionurate *of dinoxide* **of Copper.**

Thionurate *of protoxide* **of Copper.**
I.) *acid.* $C_8\,H_4\,Cu\,N_3\,S_2\,O_{12} + Aq$

Thionurate of Lead. $C_8\,H_3\,Pb_2\,N_3\,S_2\,O_{12} + 2\,Aq$ Soluble in dilute chlorhydric acid.

Thionurate of Lime.

Thionurate of Manganese. $C_8\,H_3\,Mn_2\,N_3\,S_2\,O_{12} + 2\,Aq$ Insoluble in cold, scarcely at all soluble in hot water. (Merrick, *Thesis of Lawrence Scientific School*, Cambridge, 1859.)

Thionurate of Soda.
I.) *normal.* Sparingly soluble in hot water, separating out again almost entirely as the solution cools. (Merrick, *loc. cit.*)

Thionurate of Zinc. $C_8\,H_4\,Zn\,N_3\,S_2\,O_{12} + Aq$ Very sparingly soluble in water.

Thionylamid. $N_2\left\{\begin{matrix} S_2\,O_2{}'' \\ H_4 \end{matrix}\right.$ Insoluble in water, by which it is soon decomposed, however. Decomposed at once by alkaline solutions. (Schiff.)

Thionylamic Acid. $N\left\{\begin{matrix} H_2 \\ S_2\,O_2{}'' \end{matrix}\right. . O, H\,O$ Easily decomposed.

ThioSalicol. *Vid* SulphoSalicylous Acid.

ThioSinamin. (*Rhodalin. SulphoCyanide of Allylammonium.*) $C_8\,H_8\,N_2\,S_2 = N_2\left\{\begin{matrix} C_2\,S_2{}'' \\ C_6\,H_5 \\ H_3 \end{matrix}\right.$ or $\left.\begin{matrix} N\left\{\begin{matrix} H_3 \\ C_6\,H_5 \end{matrix}\right. \\ C_2\,N \end{matrix}\right\}S_2$ Soluble in water, especially when this is warm. Easily soluble in alcohol, and ether. It is partially precipitated from the alcoholic solution on the addition of water. (Dumas & Pelouze.) After having been fused, it is less soluble in water. (Aschoff.) When thiosinamin is dissolved in boiling water it rarely crystallizes out again as the solution cools, if this is left at rest, but on strongly agitating this supersaturated cold solution it solidifies at once. Again, if thiosinamin is melted beneath a small quantity of water it remains as a viscous layer below the water for a long time after it has become cold, but on being agitated it solidifies immediately. (Berthelot & De Luca, *Ann. Ch. et Phys.*, (3.) **44.** 499.)

ThioSinEthylamin. *Vid.* EthylThiosinamin.

ThioSinNaphtylamin. *Vid.* NaphtylThioSinamin.

ThioSinPhenylamin. *Vid.* PhenylThioSinamin.

ThioTolamic Acid. *Vid.* ThioToluic Acid.

ThioToluic Acid. (*ThioTolamic Acid. ToluenylSulphaminic Acid.*) $C_{14}\,H_9\,N\,S_2\,O_8 = N\left\{\begin{matrix} C_{14}\,H_7 \\ S_2\,O_4{}'' \end{matrix}\right. . H\,O, H\,O$ Not isolated. All of its salts are readily soluble in water.

ThioToluate of Ammonia. $C_{14}\,H_8\,(N\,H_4)\,N\,S_2\,O_8$ Permanent in dry air, but gradually decomposes in moist air. Very soluble in water. Readily soluble in spirit, and absolute alcohol. Insoluble in ether. (Hilkenkamp.)

ThioToluate of Baryta. Soluble in water, and easily in spirit. Insoluble in absolute alcohol or ether. (Hilkenkamp.)

ThioToluate of Potash. $C_{14}\,H_8\,K\,N\,S_2\,O_8$ Soluble in water, and in boiling absolute alcohol; but less soluble in both the liquids than the ammonia-salt. (Hilkenkamp.)

ThioToluate of Soda. Easily soluble in water. Sparingly soluble in alcohol. Insoluble in ether. (Hilkenkamp.)

ThioToluol. *Vid.* SulphoToluol.

Thorium. Th Unacted upon by water, either hot or cold. When treated with dilute sulphuric acid the pulverulent metal is somewhat acted upon at first, but this action soon becomes less rapid, and the mixture may now be warmed, without occasioning the solution of any considerable quantity of thorium, unless the digestion be long continued. Fluorhydric acid has no more action upon it than sulphuric acid, and nitric acid attacks it, if anything, less readily than these; the metal may even be boiled with nitric acid, without dissolving to any great extent. On the other hand, thorium is very easily soluble in chlorhydric acid, complete solution being very quickly effected when the acid is warm. Unacted upon by aqueous solutions of the caustic alkalies. (Berzelius, *Pogg. Ann.*, 1829, **16**. pp. 394, 395.)

THYMEID. Soluble in alcohol, and ether. (Lallemand.)
$C_{48}H_{34}O_8 = C_{24}H_{16}O_2'' \left.\right\} O_4$

THYMENE.

THYMIC ACID. *Vid.* Thymylic Acid.

THYMIN. *Vid.* Leucin.

THYMOL. *Vid.* Thymylic Acid.

THYMOL*chloré*. *Vid.* ChloroThymic Acid.

THYMOL*nitré*. *Vid.* NitroThymic Acid; also NitroCymene.

THYMOYL. Very sparingly soluble in water. Sparingly soluble in alcohol. Very soluble in ether, but this solution undergoes alteration after a time. Sparingly soluble in alkaline solutions. Very soluble in warm concentrated sulphuric and nitric acids, from which it is precipitated unchanged on the addition of water. (Lallemand.)
$C_{24}N_{16}O_4 = C_{24}H_{16}O_2'' \left.\right\} O_2$

THYMOYLAMID. Soluble in alcohol. (Lallemand.)
$C_{24}H_{17}NO_2 = N \left\{ \begin{matrix} C_{24}H_{16}O_2'' \\ H \end{matrix} \right.$

THYMOYLIC ACID. Very sparingly soluble in water. All of its salts are soluble in water, excepting those of lead and silver. (Lallemand, *Ann. Ch. et Phys.*, (3.) **49**. 166.)

THYMOYLATE OF LEAD. Insolnble in water.
$C_{48}H_{28}O_{16}, 3\,PbO$

THYMOYLATE OF POTASH. Soluble in water, and in absolute alcohol.

THYMOYLATE OF SILVER. Insoluble in water. (Lallemand, *loc. cit.*)

THYMOYLOL. Sparingly soluble in warm water. Very soluble in alcohol, and ether, especially when these are warm. (Lallemand, *Ann. Ch. et Phys.*, (3.) **49**. 165.)
$C_{24}H_{18}O_4 = \left.\begin{matrix} C_{24}H_{16}'' \\ H_2 \end{matrix}\right\} O_4$

THYMYLIC ACID. Soluble in about 333 pts. of water. Very readily soluble in alcohol, ether, and glacial acetic acid. According to Stenhouse, it is precipitated from the alcoholic solution in drops on the addition of water; but, according to Lallemand, no such precipitation occurs. Soluble, with combination, in aqueous solutions of the caustic alkalies. (Lallemand.) Decomposed by boiling with strong acids, and alkalies. (Stenhouse.)
(*Thymol. Hydrate of Thymyl. Isomeric with Hydrate of Cumicyl.*)
$C_{20}H_{14}O_2 = C_{20}H_{13}O, HO$

THYMYLATE *of protoxide* OF MERCURY.

I.) *basic*. Insoluble in water, alcohol, or acetic acid. Unacted upon by dilute sulphuric, or nitric acids.
$C_{20}H_{13}HgO_2, HgO$

THYMYLATE OF SILVER. Insoluble in water.

THYMYLATE OF SODA. Very soluble in water, and alcohol. A solution of this salt produces precipitates with most metallic salts. (Lallemand.)
$C_{20}H_{13}NaO_2$

THYMYLSULPHACETIC ACID. Soluble in water. All of its salts are soluble in water, and alcohol, though somewhat less soluble than the corresponding thymylsulphates.
(*SulphAceto Thymic Acid.*)
$C_{24}H_{16}S_2O_{10}$

THYMYLSULPHACETATE OF BARYTA. Soluble in water; the solution undergoing partial decomposition when rapidly evaporated. Soluble in alcohol. (Lallemand, *Ann. Ch. et Phys.*, (3.) **49**. 151.)
$C_{24}H_{15}BaS_2O_{10}$

THYMYLSULPHURIC ACID. Permanent. Very soluble in water. All of its salts are very soluble in water, and absolute alcohol, and sparingly soluble in ether.
(*Sulpho Thymic Acid.*)
$C_{20}H_{14}S_2O_8 + 2\,Aq = C_{20}H_{13}O, HO, 2\,SO_3 + 2\,Aq$

THYMYLSULPHATE OF AMMONIA. Readily soluble in water, and absolute alcohol. Sparingly soluble in ether. (Lallemand, *Ann. Ch. et Phys.*, (3.) **49**. 150.)

THYMYLSULPHATE OF BARYTA. Permanent. Soluble in water, and in absolute alcohol.
$C_{20}H_{13}BaS_2O_8$

THYMYLSULPHATE OF LEAD. Soluble in water, and in absolute alcohol.
$C_{20}H_{13}PbS_2O_8$

THYMYLSULPHATE OF POTASH. Readily soluble in water, and in absolute alcohol. Sparingly soluble in ether. (Lallemand, *loc. cit.*)

THYMYLSULPHATE OF SODA. Readily soluble in water, and absolute alcohol. Sparingly soluble in ether. (Lallemand, *loc. cit.*)

THYMYLSULPHUROUS ACID. Deliquescent. Its salts are all soluble in water.
(*Sulpho Cymenic Acid.*
Sulpho Camphic Acid.
Sulpho Cymolic Acid.
Cymene Sulphurous Acid.
$C_{20}H_{14}S_2O_6 = C_{20}H_{13}O, HO, 2\,SO_2$

THYMYLSULPHITE OF BARYTA.

I.) Readily soluble in water, alcohol, and ether.
$C_{20}H_{13}BaS_2O_6 + 2\,Aq, 3\,Aq, \&\ 4\,Aq$

II.) Very much more soluble than the preceding in water, and alcohol. (Gerhardt & Cahours.)
$C_{40}H_{27}BaS_2O_6$

THYMYLSULPHITE OF COPPER(Cu O). Easily soluble in water, and alcohol. (Sieveking.)

THYMYLSULPHITE OF LEAD. Soluble in water.
$C_{20}H_{13}PbS_2O_6 + 4\,Aq$

THYMYLSULPHITE OF LIME. Very soluble in water, and alcohol. (Sieveking.)
$C_{20}H_{13}CaS_2O_6 + 3\,Aq$

THYMYLSULPHITE OF SILVER. Soluble in water, the solution undergoing decomposition when evaporated.

THYMYLSULPHITE OF SODA. Very readily soluble in water, and alcohol. (Sieveking.)
$C_{20}H_{13}NaS_2O_6 + 5\,Aq$

TIN. Permanent. Soluble in chlorhydric acid, though scarcely at all if this be dilute and cold. Soluble in sulphuric acid, either dilute or concentrated. Most readily soluble in cold aqua-regia. Concentrated nitric acid attacks it violently, but forms an insoluble oxide. Very dilute and cold nitric acid dissolves it, however, completely. When digested in an alkaline lye it gradually dissolves.
Sn

Tin is not attacked by pure concentrated nitric acid of 1.512 @ 1.419 sp. gr.; less concentrated acids attack it violently. It is attacked, however, by the concentrated acid when this contains nitrous acid. (Millon, *Ann. Ch. et Phys.*, (3.) **6**. pp. 95, 99.) As is well known, when tin is treated with pure nitric acid, the metal is simply changed to insoluble stannic acid, nitric oxide being given off. If granulated tin is put into very weak nitric acid, say of 1.15 sp. gr., a small quantity is quietly taken up, but in a short time it is thrown down again as a white powder, containing no nitric acid. If, however, a very little chloride of ammonium is first added to the dilute acid, the reaction is different; nitrous oxide is given off, and the tin remains permanently in solution. A small proportion of chlorhydric acid answers the same purpose as the ammonia salt, for nitric acid is deoxidized, and ammonia formed. Nitrate of ammonia will not replace the chloride in this experiment. In an experiment where tin was treated with a mixture of equal parts of nitric acid of 1.39 sp. gr., and chlorhydric acid of 1.16 sp. gr., enough of the metal was taken up to make a dark, syrupy liquid of 2.24 sp. gr. Analysis showed this solution to contain about 24 equivalents of tin to 3 equivalents of nitric acid, 6 equivalents of chlorhydric acid, and 2 equivalents of chloride of ammonium. Here we have 8 equivalents of tin retained in solution by 3 equivalents of acid. Another sample made with a mixture of 4 pts. of nitric acid to 3 pts. of chlorhydric acid, was of 2.443 sp. gr., and contained 4 equivalents of tin to 1 of acid. (Ordway, *Am. J. Sci.*, 1857, (2.) **23.** 220.)

Like zinc, iron, etc., tin is much more readily acted upon by acids to which small quantities of metallic salts have been added than by the acids alone. This influence is most marked with chlorhydric acid, among the acids, and with bichloride of platinum and tartar emetic, among the metallic solutions; arsenious acid, &c. [see Zinc], not exerting any notable influence. The following experimental results were obtained: I.) 19.672 grms. of sheet tin placed in pure fuming chlorhydric acid diluted with an equal volume of water, at 21°, lost 0.562 grm. II.) 19.841 grms. of the tin in similar acid, to which had been added 15 drops of a saturated aqueous solution of tartar emetic, lost 6.296 grms. III.) 18.974 grms. of the tin in acid, like that of No. I., to which had been added 15 drops of an aqueous solution of bichloride of platinum [1 pt. of $Pt\,Cl_2$ in 10 pts. of water], lost 7.495 grms. In expressing the action of the pure chlorhydric acid upon the tin by 1, the action of the same acid plus tartar emetic may be expressed by 11, and that of the acid plus bichloride of platinum by 13. When the experiment is made at the temperature of boiling water, the difference between the platinum and antimony is in favor of the latter, and it is found that, at this temperature, the tartar emetic renders the action of chlorhydric acid upon tin 5 times more rapid, while the bichloride of platinum increases it only threefold. The influence of these small quantities of metal is still more decided when granulated tin and the chlorhydric acid of commerce are employed. 100 grammes of granulated tin were dissolved in twenty minutes by 500 grms. of commercial chlorhydric acid, to which had been added 40 drops of a saturated aqueous solution of tartar emetic; another portion of the same acid, placed under similar circumstances, but without addition of any foreign salt, when poured upon 100 grms. of granulated tin having dissolved only 19 grms. in the course of three hours. Thus, when aided by a few millionths of antimony, the chlorhydric acid dissolved a larger portion of tin in one ninth the time required by the pure acid. When the action of the boiling acid is compared with that of the cold acid, to which tartar-emetic has been added, it is found that the latter acts almost as rapidly as the former; so that in the manufacture of protochloride of tin it is probable that heat might be replaced by a small quantity of tartar-emetic, or other salt of antimony, or, on the other hand, by means of this addition the process may be made 8 or 10 times quicker. The phenomena presented by sulphuric acid, more or less dilute, in its action upon tin, do not appear to be interesting in this connection; the organic acids also are in the same predicament; in any event, the latter only act very slowly, if at all. (Millon, *C. R.*, 1825, **21.** pp. 47, 48.) In connection with Millon's experiments, compare Barreswil's observations. (*C. R.*, **21.** 292.) Tin is dissolved by the hot aqueous solutions of several salts; a boiling solution of 1 pt. of alum in 4 pts. of water, for example, dissolving it somewhat readily. So also with solutions of bisulphate of potash, chloride of ammonium (1 pt. in 4 pts. of water), normal tartrate of potash, and tartrate and borate of potash. A solution of acetate of potash also dissolved traces of it; but it is not attacked by solutions of sulphate of magnesia, sulphate of soda, nitrate of potash, or monosulphate of potash. (Cludius, *J. pr. Ch.*, 1836, **9.** 161.) Soluble to a certain extent in boiling aqueous solutions of several salts, as alum, [bi ?] sulphate of potash, and chloride of ammonium. Other salts oxidize without perceptibly dissolving it; in this class are many of the salts of the alkalies and alkaline earths, excepting nitrate, acetate, and tartrate of potash, and phosphate and borate of soda. (Berzelius, *Lehrb.*, **2.** 589.)

TINKAL. *Vid. bi*Borate of Soda.

TITANIC ACID. (*Titanic Oxide. Binoxide of Titanium.*) $Ti\,O_2$ There are two isomeric modifications (according to Berzelius):

a) *Soluble.*

a = *hydrated.* Insoluble in water. Easily soluble in acids. Slightly soluble in aqueous solutions of the alkaline carbonates. A complete solution in an alkaline carbonate can only be obtained by adding the solution of the titanium salt, drop by drop, to the alkaline solution, and allowing the precipitate to dissolve entirely before adding a new portion of the titanium salt. After the acid has been some time precipitated, it loses its solubility in great measure. On boiling its solution in carbonate of ammonia for some time the acid is reprecipitated; the same result may be obtained with the solution in the fixed alkaline carbonates, if these are first mixed with chloride of ammonium. (Berzelius's *Lehrb.*, **2.** 389.) After having been washed with hot water, it is less soluble than when washed with cold water. Even when moist it is very sparingly soluble in sulphurous acid, and the portion dissolved is completely reprecipitated on boiling the solution. (Berthier, *Ann. Ch. et Phys.*, (3.) **7.** 76.) Demoly also distinguishes two modifications of titanic acid: "ordinary," being the ordinary precipitated hydrate, soluble in acids, to which he assigns the formula, $3\,Ti\,O_2 + 5\,H\,O$, and metatitanic acid, being that which has been dried at 140°, or in vacuo, and is insoluble in acids; the formula of this he writes, $Ti_3\,O_6 + 2\,H\,O$. The salts of ordinary titanic acid are soluble in water, but those of metatitanic acid are insoluble.

β) *Insoluble.*

a = *ignited.* Insoluble in water, acids, excepting fluorhydric acid, or aqueous solutions of the caustic or carbonated alkalies. When digested with concentrated sulphuric acid at a gentle heat, until the excess of acid is evaporated, a salt remains which is soluble in water. (Berzelius, *Lehrb.*) Anhydrous titanic acid, which has not been ignited, is soluble in dilute acids. When solutions of titanic acid in chlorhydric or sulphuric acid are boiled they undergo decomposition, the titanic acid being precipitated completely from the sulphuric acid solution, in its insoluble modification. (H. Rose, *Pogg. Ann.*, **83.** 150.)

TITANATE *of protoxide* **OF IRON.**
$Fe\,O,\ Ti\,O_2$

TITANATE *of sesquioxide* **OF IRON.** Insoluble in water. Unacted upon by boiling sulphuric or chlorhydric acid. (Wœhler.)

TITANATE OF LIME. Occurs as the mineral *Perofskite.* Scarcely at all acted upon by chlorhydric or other acids, excepting hot sulphuric acid, which decomposes it, sulphate of lime separating out.
$Ca\,O,\ Ti\,O_2$

TITANATE OF MANGANESE. Insoluble in water.

TITANATE OF POTASH.

I.) *mono.* Decomposed by water, with formation of a soluble basic and an insoluble acid salt.

II.) *basic.* Soluble in water.

III.) *acid.* Insoluble in water. Soluble in concentrated chlorhydric acid.

TITANATE OF SODA.

I.) Decomposed by water.
$Na\,O,\ Ti\,O_2$

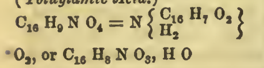
II.) *acid.* Insoluble in water.

TITANATE OF ZIRCONIA.

TITANIUM. Soluble in aqua-regia. Most of the metallic compounds of titanium are insoluble in water. None of them are known to be soluble in alcohol.
Ti

TOLENE.
$C_{20}\,H_{16}$

TOLUAMIC ACID. Like benzamic acid, which it resembles, it dissolves readily in acids, with combination. (Cahours, *Ann. Ch. et Phys.*, (3.) **53.** 332.)
(*Toluylamic Acid.*)


$C_{16}\,H_9\,N\,O_4 = N\left\{\begin{matrix} C_{16}\,H_7\,O_2 \\ H_2 \end{matrix}\right\}O_2$, or $C_{16}\,H_8\,N\,O_3,\ H\,O$

TOLUIC ACID. Readily soluble in boiling, somewhat less soluble in cold water. Soluble in almost all proportions in alcohol, ether, and wood-spirit. (Noad.)
(*Toluylic Acid.*)
$C_{16}\,H_8\,O_4 = C_{16}\,H_7\,O_3,\ H\,O$

An isomeric modification (AlphaToluic Acid) observed, by Strecker & Cannizzaro, is sparingly soluble in cold, abundantly soluble in boiling water. Largely soluble in alcohol, and ether. Its salts, with lime and baryta, are very soluble in water, the ammonia-salt soluble in water, the salts of copper (Cu O), and silver, precipitates, the latter soluble in boiling water.

TOLUATE OF AMMONIA. Soluble in water.

TOLUATE OF BARYTA. Soluble in water.
$C_{16}\,H_7\,Ba\,O_4$

TOLUATE OF COPPER. Very sparingly soluble in water. Soluble in ammonia-water.
$C_{16}\,H_7\,Cu\,O_4$

TOLUATE OF ETHYL. Sparingly soluble, or insoluble, in water.
$C_{16}\,H_7\,(C_4\,H_5)\,O_4$

TOLUATE OF LIME. Soluble in water.

TOLUATE OF PHENYL. Soluble in a mixture of alcohol and ether.
$C_{16}\,H_7\,(C_{12}\,H_5)\,O_4$

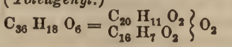
TOLUATE OF POTASH. Readily soluble in water.

TOLUATE OF SILVER. Soluble in warm, less soluble in cold water.
$C_{16}\,H_7\,Ag\,O_4$

TOLUATE OF SODA. Still more soluble than the potash-salt.

TOLENE (in Balsam of Tolu).
$C_{20}\,H_{16}$

TOLEUGENIC ACID (Anhydrous). Insoluble in water. Somewhat readily soluble in boiling alcohol, and still more easily in ether. (Cahours.)
(*Toleugenyl.*)


$C_{36}\,H_{18}\,O_6 = \left.\begin{matrix} C_{20}\,H_{11}\,O_2 \\ C_{16}\,H_7\,O_2 \end{matrix}\right\}O_2$

TOLUENE. *Vid.* Hydride of Toluenyl.

TOLUENE*chloré*, &c. *Vid.* Hydride of ChloroToluenyl, &c.

TOLUENOL*trichloré*. *Vid.* ChloroToluric Acid.

TOLUENYL. Not isolated.
(*Tolyl.*)
$C_{14}\,H_7$

TOLUENYLAMIN. *Vid.* Toluidin.

*Tri***TOLUENYLAMIN.** Sparingly soluble in water, or in cold alcohol; more soluble in boiling water, and still more readily in ether. (Cannizzaro.)
(*TriBenzylamin.*)
$C_{42}\,H_{21}\,N = N\,\}\,(C_{14}\,H_7)_3$

TOLUENYLSULPHAMINIC ACID. *Vid.* ThioToluic Acid.

TOLUENYLSULPHUROUS ACID. Very deliquescent. Soluble in water, the solution undergoing decomposition when evaporated.
(*Sulpho Toluic Acid.*
Sulpho Toluenic Acid.
SulphoBenzoenic Acid.
SulphoDracylic Acid.
TooluolSulphuric Acid.
Sulphite of Toluenyl.)
$C_{14}\,H_8\,S_2\,O_6 + 2\,Aq = C_{14}\,H_7\,O,\ H\,O,\ 2\,S\,O_2 + 2\,Aq$

TOLUENYLSULPHITE OF AMMONIA. Soluble in water.

TOLUENYLSULPHITE OF BARYTA. Permanent. Very easily soluble in water. (Deville.)
$C_{14}\,H_7\,Ba\,S_2\,O_6$

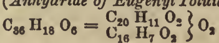
TOLUENYLSULPHITE *of protoxide* **OF COPPER.** Appears to be soluble in water.

TOLUENYLSULPHITE OF LEAD. Very soluble in water.

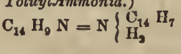
TOLUENYLSULPHITE OF POTASH. Very soluble in water.

TOLUENYLSULPHITE OF SILVER. Appears to be soluble in water.

TOLUEUGENYL. Insoluble in water. Tolerably easily soluble in boiling alcohol; more readily soluble in ether. (Cahours, *Ann. Ch. et Phys.*, (3.) **52.** 204.)
(*Anhydride of Eugenyl Toluic Acid.*)


$C_{36}\,H_{18}\,O_6 = \left.\begin{matrix} C_{20}\,H_{11}\,O_2 \\ C_{16}\,H_7\,O_2 \end{matrix}\right\}O_2$

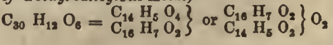
TOLUIDIN. Sparingly soluble in cold, more readily soluble in warm water. Tolerably soluble in alcohol, ether, wood-spirit, acetone, and the fatty and essential oils. Readily soluble in bisulphide of carbon. (Muspratt & Hofmann.)
(*Toluenylamin.*
TolulAmmonia.)


$C_{14}\,H_9\,N = N\left\{\begin{matrix} C_{14}\,H_7 \\ H_2 \end{matrix}\right.$

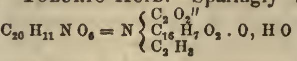
TOLUIDINE*bromé*. *Vid.* BromoToluidin.

TOLUOL. *Vid.* Hydride of Toluenyl.

TOLUOSALICYL. Insoluble in cold, sparingly soluble in boiling water. Sparingly soluble in cold, tolerably soluble in boiling alcohol; more readily soluble in ether. Unacted upon by boiling potash-lye. (Cahours, *Ann. Ch. et Phys.*, (3.) **52.** 195.)
(*Salicylide of Toluyl. Anhydride of ToluylSalicylous Acid.*)


$C_{30}\,H_{12}\,O_6 = \left.\begin{matrix} C_{14}\,H_5\,O_4 \\ C_{16}\,H_7\,O_2 \end{matrix}\right\}$ or $\left.\begin{matrix} C_{16}\,H_7\,O_2 \\ C_{14}\,H_5\,O_2 \end{matrix}\right\}O_2$

TOLURIC ACID. Sparingly soluble in cold, abundantly soluble in boiling water. Readily


$C_{20}\,H_{11}\,N\,O_6 = N\left\{\begin{matrix} C_2\,O_2'' \\ C_{16}\,H_7\,O_2\,.\,O,\ H\,O \\ C_2\,H_3 \end{matrix}\right.$

soluble in cold, and in all proportions in boiling alcohol. Very difficultly and sparingly soluble in pure ether; but dissolves in a mixture of ether and alcohol. Soluble, without decomposition, in cold concentrated chlorhydric acid, but the solution is decomposed by boiling. Easily soluble, with combination, in alkaline solutions. (Kraut, *Ann. Ch. u. Pharm.*, **98.** 365.)

TOLURATE OF BARYTA. Easily soluble in hot water. (Kraut, *loc. cit.*)
$C_{30}H_{10}BaNO_6 + 5Aq$

TOLURATE *of protoxide* OF IRON. Ppt. Soluble in alcohol. (Kraut, *loc. cit.*)

TOLURATE OF LEAD. Ppt.

TOLURATE OF LIME. Easily soluble in hot, sparingly soluble in cold water. (Kraut, *loc. cit.*)
$C_{20}H_{10}CaNO_6 + 3Aq$

TOLURATE OF SILVER. Abundantly soluble in boiling, less soluble in cold water. (Kraut, *loc. cit.*)
$C_{20}H_{10}AgNO_6$

TOLURATE OF SODA. Soluble in water.

TOLUYLIC ACID. *Vid.* Toluic Acid.

TOLUYLAMMONIA. *Vid.* Toluidin.

TOLUYLAMIC ACID. *Vid.* Toluamic Acid.

*Alpha*TOLUYLAMIN. Soluble in hot, less soluble in cold water. (Strecker.)

TOLUYLUREA.
(*Carbonyl Toluylbiamid.*)

$$C_{18}H_{10}N_2O_4 = N_2\left\{\begin{matrix} C_2O_2'' \\ C_{16}H_7O_2 \\ H_3 \end{matrix}\right.$$

TOLYL. Same as Toluenyl, *q. v.*
$C_{14}H_7$

Traubensœure. *Vid.* ParaTartaric Acid.

TREHALOSE. Easily soluble in water. Almost insoluble in cold, tolerably easily soluble in boiling alcohol. Insoluble in ether. Decomposed by boiling dilute sulphuric acid.

$$C_{12}H_{11}O_{11} = \left.\begin{matrix} C_{12}H_8O_6'' \\ H_2 \end{matrix}\right\}O_4 + Aq$$

TRI or TRISACETATE (&c.) OF *X*. See under Acetate (&c.) of *X*, as *tris*Acetate of *X*, *tri*Sulphate of *X*, and the like.

TRIGENIC ACID. Sparingly soluble in water. Nearly insoluble in alcohol. (Liebig.) Soluble in chlorhydric acid.

$$C_8H_7N_3O_4 = N_2\left\{\begin{matrix} C_2O_2'' \\ C_2N \\ C_4H_3 \\ H_3 \end{matrix}\right. . O, HO$$

TRIGENATE OF SILVER. Soluble in boiling, less soluble in cold water.
$C_8H_6AgN_3O_4$

TRITYL(of Gerhardt). *Vid.* Propyl.

TRITYLAMIN. *Vid.* Propylamin.

TRITYLENE(of Gerhardt). *Vid.* Propylene.

TRITYLENE*chloré*, &c. *Vid.* Chloro (&c.) Propylene.

TRITYLIC ALCOHOL. *Vid.* Hydrate of Propyl.

TRITYLSULPHURIC ACID. *Vid.* SulphoPropylic Acid.

TROPEOLIC ACID(from *Tropæolum majus*). Soluble in water, alcohol, and ether. (Mueller.)

TUNGSTIC ACID.

α.) Ordinary, insoluble modification.

a. = anhydrous. Soluble in water, especially when this is hot. Scarcely at all soluble in water which contains any portion of acid. (Berzelius.) It appears to be insoluble in all acids, excepting concentrated chlorhydric and fluorhydric acids, in which it is very sparingly soluble. With the exception of the alkaline salts, all of its compounds are insoluble in water.
WO_3

Somewhat soluble in aqueous solutions of the alkalies, even ammonia, especially when these are boiling. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 35.) Laurent (*Ann. Ch. et Phys.*, (3.) **21.** 58) argues, that there are several isomeric compounds, as "para," "iso," and "poly," tungstic acids, but his assertions have been disproved by Lotz and Riche. Laurent's statements are so vague, that I have made no effort to record them here.

b = hydrated. Riche, (*Ann. Ch. et Phys.*, (3.) **50.** 35) describes two hydrates of common or "insoluble" modification of tungstic acid, viz. HO, WO_3, and $2HO, WO_3$, both of which are insoluble in water. The bihydrate dissolves, however, with combination, in aqueous solutions of the tungstates while the monohydrate is insoluble in these. According to Anthon (*J. pr. Ch.*, **9.** 6, cited in *Wittstein's Handw.*) the dry hydrate, $WO_3 + 2HO$, is soluble in 250 @ 300 pts. of cold water, and in 30 pts. of boiling water; and nothing is precipitated from the aqueous solution on the addition of acids. When freshly precipitated, it is soluble in aqueous solutions of the caustic and carbonated alkalies.

β. Soluble modification. Known only in cold aqueous solution; this solution being decomposed when boiled, or when evaporated so far that the solution is very concentrated.
(*Meta Tüngstic Acid.*)

The salts of metatungstic acid are slowly decomposed when dissolved in cold water; but immediately when treated with alkaline solutions. The alkaline metatungstates are much more soluble in water than those of ordinary tungstic acid. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 43.) The metatungstates of the alkaline earths and of the metals appear to be soluble in water, excepting those of dinoxide of mercury (insoluble), and of lead (sparingly soluble). (Lotz, *Ann. Ch. u. Pharm.*, **91.** 74.) The alkaline tungstates ("ordinary") are soluble in water, but the others, with the exception of the magnesia salt, appear to be all insoluble in water.

TUNGSTATE OF ALUMINA.

I.) *normal.* Insoluble in water, or in an aqueous solution of tungstate of soda. Easily soluble in solutions of alum, of caustic soda, and ammonia, and of phosphoric, oxalic, and tartaric acids. (Lotz, *Ann. Ch. u. Pharm.*, **91.** 66.)

II.) Soluble in an aqueous solution of alum. (Lotz, *loc. cit.*)
$Al_2O_3, 7WO_3 + 9Aq$

TUNGSTATE OF AMMONIA.

I.) Very sparingly soluble in water. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 67.)
$NH_4O, 3HO, 4WO_3 + Aq$

II.) Soluble in water. (Riche, *loc. cit.*)
$NH_4O, 3HO, 4WO_3 + 3Aq$

III.) 100 pts. of boiling water dissolve 10.4 pts. of it at the temperature of boiling, and 3 pts. at the ordinary temperature; it is much more readily soluble in ammonia-water. (Riche, *loc. cit.*, p. 53.)
$NH_4O, 3HO, 4WO_3 + 2Aq$; same as the old "$NH_4O, 3WO_3 + 2Aq$" (Riche).

IV.) Permanent. Difficultly and slowly soluble in water. When not powdered, it seems to be almost entirely insoluble in cold water. Soluble in 26.1 pts. of water at 10.7°,
"Bitungstate" of Berzelius & Anthon "($NH_4O, 2WO_3 + Aq$)" $3NH_4O, 7WO_3 + 6Aq$; or $2(NH_4O, 2WO_3)$; $NH_4O, 3WO_3 + 6Aq$(of Lotz).

and in 5.8 pts. of boiling water. On boiling the aqueous solution ammonia is evolved and a more soluble salt is formed. (Lotz, *Ann. Ch. u. Pharm.*, **91.** 52.) Permanent. Soluble in 25 @ 28 pts. of cold water. Insoluble in alcohol. (Anthon.)

V.) Soluble in water. (Lotz.)
$2 (NH_4O, 2 WO_3) ; NH_4O, 3 WO_3 + 3 Aq$

β or *Meta*TUNGSTATE OF AMMONIA.

I.) *normal.* Readily soluble in water, being much more soluble than the ordinary tungstate of ammonia. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 64.)
$NH_4O, HO, 2 W_2O_6 + 3 Aq$

II.) *acid.* Much more soluble in water than the normal metatungstate of ammonia. 100 pts. of cold water dissolve 288 pts. of it; soluble in all proportions in hot water. Insoluble in alcohol or ether. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 66.)

(*Octahedral.*)
$NH_4O, 3 HO, 3 W_2O_6 + 10 Aq$ (of Riche). $2 (NH_4O, 4 WO_3) + 15 Aq$; i. e. $NH_4O, 3 HO, 4 WO_3 + 9 Aq$ (of Lotz). “$NH_4O, 3 WO_3 + 5 Aq$” (of Margueritte). “$(NH_4)\frac{5}{6} H\frac{1}{6} W_3O_{10} + 5 Aq$, or metatungstate” (of Laurent).

Efflorescent. Very readily soluble in water. Soluble in 0.84 pts. of water at 1.5°; and much more soluble in warm water. The aqueous solution saturated at 40° becomes almost entirely solid on cooling. Sparingly soluble in ordinary spirit; but almost, if not entirely, insoluble in absolute alcohol. (Lotz, *Ann. Ch. u. Pharm.*, **91.** 72.)

TUNGSTATE OF AMMONIA & OF CADMIUM. Soluble in water acidulated with nitric acid. (Lotz.)
$4 (3 CdO, 7 WO_3) ; 3 NH_4O, 7 WO_3 + 35 Aq$

TUNGSTATE OF AMMONIA & OF MAGNESIA. Very difficultly soluble in water. Soluble in water acidulated with nitric acid. (Lotz.)
$2 (MgO, 2 WO_3) ; NH_4O, 3 WO_3 + 10 Aq$

TUNGSTATE OF AMMONIA & *of protoxide* OF MERCURY. Insoluble in water. Decomposed by acids and by alkaline solutions. (Anthon.)
“$NH_4O, HgO, 2 WO_3 + Aq$”

TUNGSTATE OF AMMONIA & *of binoxide* OF MOLYBDENUM.

I.) *basic.* Insoluble in water. (Berzelius.)

TUNGSTATE OF AMMONIA & OF POTASH (of Margueritte).
$NH_4O, KO, 4 WO_2 + 6 Aq$

TUNGSTATE OF AMMONIA & OF SODA. Very sparingly soluble, or insoluble, in cold water. (Lotz.)
$2 (NH_4O, 2 WO_3) ; NaO, WO_3$

TUNGSTATE OF AMMONIA & OF ZINC. Somewhat soluble in boiling water. Easily soluble in aqueous solutions of tungstate of ammonia, and sulphate of zinc, and in phosphoric, oxalic, tartaric, and dilute nitric acids. (Lotz.)
$NH_4O, 3 WO_2 ; 2 (ZnO, 2 WO_3) + 13 Aq$

TUNGSTATE OF BARYTA.

I.) *mono.* Insoluble in water, or in boiling phosphoric acid. Soluble in boiling, less soluble in cold, oxalic acid. (Anthon.)
“BaO, WO_3”

II.) *bi.* Insoluble in cold, very sparingly soluble in boiling water. Partially soluble in boiling oxalic acid. (Anthon.) Recently precipitated tungstate of baryta is soluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.)
$BaO, 2 WO_3 \& + 3 Aq$

III.) $3 BaO, 7 WO_3$

IV.) When recently precipitated, it is slightly soluble in water acidulated with nitric acid. (Lotz.)
$3 BaO, 4 HO, 7 WO_3 + 4 Aq$

TUNGSTATE OF *ter*BROMIDE OF TUNGSTEN.
$2 WBr_3, WO_3$

TUNGSTATE OF CADMIUM.

I.) *mono.* Insoluble in water. Soluble in ammonia-water, and in hot phosphoric and oxalic acids. (Anthon.)
“$CdO, WO_3 \& + 2 Aq$”

II.) *bi.* Insoluble in water. Soluble in ammonia-water, and in hot phosphoric, oxalic, and acetic acids. (Anthon.)
“$CdO, 2 WO_3$”

TUNGSTATE OF CHLORIDE OF TUNGSTEN.

I.) Rapidly decomposed by water. Readily soluble, with decomposition, in ammonia-water. (Wœhler.)
$WCl_3; 2 WO_3$

II.) (Bonnet.)
$2 WCl_3, WO_3$

TUNGSTATE *of sesquioxide* OF CHROMIUM.

I.) *normal.* Soluble in an aqueous solution of terchloride of chromium, and in phosphoric, oxalic, and tartaric acids. (Lotz.)
$Cr_2O_3, 3 WO_3 + 7 Aq \& 13 Aq$

II.) Insoluble in water, or an aqueous solution of tungstate of ammonia. Soluble in a solution of terchloride of chromium. (Lotz.)
$Cr_2O_3, 8 WO_3 + 9 Aq$

TUNGSTATE OF COBALT.

I.) Insoluble in water, or cold nitric acid. Soluble in ammonia-water, and in warm acetic and phosphoric acids, partially soluble in oxalic acid. (Anthon.)
“$CoO, WO_3 \& + 2 Aq$”

II.) *bi.* Insoluble in water. Imperfectly soluble in oxalic acid. Soluble in ammonia-water, and in phosphoric and acetic acids. (Anthon.)
“$CoO, 2 WO_3 \& + 3 Aq$”

TUNGSTATE *of protoxide* OF COPPER.

I.) *mono.* Insoluble in water, or oxalic acid. Soluble in ammonia-water, and in phosphoric and acetic acids. (Anthon.)
“$CuO, WO_3 + 2 Aq$”

II.) *bi.* Insoluble in water, or nitric acid. Soluble in ammonia-water. (Anthon.)
“$CuO, 2 WO_3 + 4 Aq$”

TUNGSTATE *of protoxide* OF IRON.

I.) Insoluble in water. Soluble in chlorhydric, sulphuric, and nitric acids, without decomposition, in the cold, but with complete decomposition and separation of WO_3 on boiling. Soluble in hot phosphoric and oxalic acids. (Anthon.)
“$FeO, WO_3 \& + 3 Aq$”

II.) *bi.* Insoluble in water. Soluble in hot phosphoric and oxalic acids. Decomposed by dilute chlorhydric acid, and by a solution of caustic potash. (Anthon.)
“$FeO, 2 WO_3 + 2 Aq$”

TUNGSTATE *of sesquioxide* OF IRON. Easily soluble in an aqueous solution of terchloride of iron, even in the cold; also soluble in a boiling solution of tungstate of ammonia. (Lotz.)

TUNGSTATE *of protoxide* OF IRON & OF MANGANESE. Partially soluble in concentrated chlorhydric acid.
$3 (FeO, WO_3) ; MnO, WO_3$

TUNGSTATE OF LEAD.

I.) Insoluble in water, or in cold nitric acid. “PbO, WO_3” Decomposed by hot nitric acid. Soluble in an aqueous solution of caustic potash. (Anthon.) The native compound (*Scheelenite*) is soluble in potash-lye, and is decomposed by nitric acid, tungstic acid separating out.

II.) Insoluble in water, even when this is acidu- $2(PbO, 2WO_3); PbO, WO_3 + 10Aq$ lated with nitric acid, or in aqueous solutions of tungstate of ammonia, or nitrate of lead. Soluble in a solution of caustic soda, and in boiling phosphoric acid. (Lotz, *Ann. Ch. u. Pharm.*, **91.** 65.) “Tungstate of lead” is soluble in a saturated aqueous solution of chloride of sodium. (Becquerel, *C. R.*, 1845, **20.** 1523.)

β or *Meta*TUNGSTATE OF LEAD. Sparingly $PbO, 4WO_3 + 6HO$? soluble in water. Easily soluble in nitric acid. (Lotz, *loc. cit.*, p. 74.)

TUNGSTATE OF LIME. Permanent. Insolu- “CaO, WO_3” ble in water. A boiling aqueous solution of caustic potash removes a portion of the acid.

When recently precipitated, it is soluble in an aqueous solution of chloride of ammonium. (Wackenroder, *Ann. Ch. u. Pharm.*, **41.** 316.) The native compound (*Scheelite*) is decomposed by chlorhydric and nitric acids, with separation of a yellow powder, which is soluble in ammonia-water.

TUNGSTATE OF LITHIA.

I.) *mono.* Permanent. Very soluble in water. “LiO, WO_3” (Anthon.)

II.) *bi.* Permanent. Rather less soluble in “$LiO, 2WO_3$” water than the soda salt. (Anthon.)

TUNGSTATE OF MAGNESIA. Permanent. “MgO, WO_3” Readily soluble in water.

TUNGSTATE OF MANGANESE.

I.) *mono.* Insoluble in water. Soluble in “MnO, WO_3” $\& + 2Aq$ warm phosphoric and oxalic acids, also sparingly soluble in acetic acid. Insoluble in cold chlorhydric acid. (Anthon.)

II.) *bi.* Insoluble in water. Soluble in aque- “$MnO, 2WO_3 + 3Aq$” ous solutions of phosphoric, oxalic, and nitric acids. (Anthon.)

III.) When recently precipitated, it is soluble $2(MnO, 2WO_3); MnO, WO_3 \& + 3Aq \& 11Aq$ in a small amount of water acidulated with nitric acid. (Lotz.)

TUNGSTATE *of dinoxide* OF MERCURY. Insol- “Hg_2O, WO_3” uble in water. (Berzelius.)

β or *Meta*TUNGSTATE *of dinoxide* OF MERCURY. Insoluble in water. Easily soluble in nitric acid. (Lotz, *Ann. Ch. u. Pharm.*, **91.** 74.)

TUNGSTATE *of protoxide* OF MERCURY.

I.) Insoluble in water. (Anthon.)
“$3HgO, 2WO_3$”

II.) Insoluble in water. (Anthon.)
“$2HgO, 3WO_3$”

TUNGSTATE *of binoxide* OF MOLYBDENUM. Per- $MoO_2, 2WO_3$ manent. Soluble in water. Insoluble in an aqueous solution of chloride of ammonium, or in alcohol of 0.87 sp. gr. (Berzelius.)

TUNGSTATE OF NICKEL.

I.) *mono.* Insoluble in water, or oxalic acid. “$NiO, WO_3 + 6Aq$” Soluble in warm ammonia-water, and in boiling phosphoric and acetic acids. (Anthon.)

II.) *bi.* Insoluble in water. Slightly soluble “$NiO, 2WO_3 \& + 4Aq$” in oxalic acid. Completely soluble in phosphoric and acetic acids. (Anthon.)

III.) Soluble in a small quantity of water $2(NiO, 2WO_3); NiO, WO_3 \& + 14Aq$ acidulated with nitric acid, and in an aqueous solution of sulphate of nickel. Insoluble in a solution of tungstate of ammonia. (Lotz.)

TUNGSTATE OF POTASH.

I.) *mono.*

a = *anhydrous.* Very soluble in water, with KO, WO_3 reduction of temperature; much more readily in hot than in cold. 100 pts. of boiling water dissolve about 152.2 pts. of it; and 100 pts. of cold water about 52 pts. The aqueous solution is not miscible with alcohol, but when left in contact with alcohol the latter gradually combines with the water, and the salt is precipitated. Almost entirely insoluble in alcohol. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 48.)

b = *hydrated.* Not deliquescent when pure. $KO, WO_3 + Aq$ (Riche.)

c = “$KO, WO_3 + 5Aq$”(of Anthon). Hygroscopic. Soluble in 1 pt. of cold, and in 0.5 pt. of boiling water. It is precipitated from the aqueous solution on addition of sulphuric, chlorhydric, or nitric acids. (Anthon.) Insoluble in alcohol.

II.) *bi.* Permanent. Soluble in 100 pts. of “$KO, 2WO_3 + 2Aq$” water at 16°, and in 8.5 pts. of boiling water. On the addition of acids, it is partially precipitated from the aqueous solution. (Anthon.) Insoluble in alcohol.

III.) *Insoluble Tungstate of Potash* (“*not, how-* $KO, 2WO_3 + 3Aq$ *ever, a salt of insoluble* WO_3”). Very sparingly soluble in water. 100 pts. of water dissolve 6.6 pts. of it at boiling, and 2.15 pts. in the cold. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 50.)

IV.) *β* or *Meta*TUNGSTATE OF POTASH. KO, W_2O_6 (Same as the old “Pentacid Tungstate,” = “$KO, 5WO_3 + 8Aq$.”) Permanent. Very soluble in cold, soluble in all proportions in boiling water. The aqueous solution is partially decomposed on prolonged ebullition. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 61.)

V.) Soluble in water.
“$KO, 5WO_3 + 6Aq$”(of Margueritte).

TUNGSTATE OF POTASH & *of binoxide* OF TUNGSTEN. Insoluble in water, alcohol, acids, or alkaline solutions. (Laurent.)

TUNGSTATE OF SILVER.

I.) *bi.* Insoluble in water. Scarcely at all “$AgO, 2WO_3$” soluble in phosphoric or acetic acids; more readily soluble in oxalic acid, and in aqueous solutions of caustic ammonia, and potash. (Anthon.)

TUNGSTATE OF SODA.

I.) *mono.* Permanent. Soluble in 4 pts. of $NaO, WO_3 + 2Aq$ cold, and in 2 pts. of boiling water (Vauquelin & Hecht); in 1.1 pt. of cold, and in 0.5 pt. of boiling water. (Anthon.) 100 pts. of water at 100° dissolve 123.58 pts. of it; at 15°, 55.52 pts.; and at 0°, 40.92 pts. of it. Insoluble in alcohol. Decomposed by acids. Carbonic acid precipitates an insoluble tungstate (analogous to the potash salt No. III.) from the aqueous solution. (Riche, *Ann. Ch. et Phys.*, (3.) **50.** 52.)

II.) *bi.* Permanent. Soluble in 8 pts. of cold
$NaO, 2WO_3 + 4Aq$ water. Insoluble in alcohol. (Anthon.) Malaguti has obtained a salt with 4½ equivalents, H O, which is less soluble than Anthon's.

III.) *β* or *Meta*TUNGSTATE OF SODA. (Same
NaO, W_2O_6 as Margueritte's Bitungstate.) Soluble in water. (Riche.)

IV.) "$NaO, 4WO_3 + 3Aq$" (of Margueritte).

TUNGSTATE OF SODA & OF TUNGSTEN. Sol-
$NaO, WO_3; WO_2, WO_3$ uble, with decomposition, in fluorhydric acid, but is unacted upon by other acids, even boiling aqua-regia, or by alkaline solutions. (Wœhler.)

TUNGSTATE OF STRONTIA.

I.) *mono.* Insoluble in water. (Anthon.)
SrO, WO_3

II.) *bi.* Insoluble in cold water; completely
"$SrO, 2WO_3 + 5Aq$" soluble in hot water, and in oxalic and phosphoric acids. (Anthon.)

III.) When recently precipitated, it is soluble
$3SrO, 7WO_3 + 4Aq$ in a small amount of water acidulated with nitric acid. (Lotz.)

TUNGSTATE OF THORIA. Insoluble in water.
ThO, WO_3 (Berzelius.) Ppt., from acid as well as neutral tungstates. (Berzelius, *Pogg. Ann.*, 1829, **16.** 412.)

TUNGSTATE *of protoxide* OF TIN. Insoluble in
"$SnO, WO_3 + 6Aq$" water. Soluble in oxalic acid, and in an aqueous solution of caustic potash. Slowly soluble in hot phosphoric acid. (Anthon.)

TUNGSTATE *of binoxide* OF TIN. Insoluble in an aqueous solution of tungstate of ammonia. Soluble in a solution of chloride of tin, in phosphoric and in tartaric acids. (Lotz.)

TUNGSTATE OF TUNGSTEN. Slowly, but com-
(*Blue Oxide of Tungsten.*) pletely, soluble in an
$WO_2, WO_3 = W_2O_5$ aqueous solution of caustic potash.

TUNGSTATE *of protoxide* OF URANIUM. In-
$2UrO, 3WO_3 + 6Aq$ soluble in concentrated sulphuric acid. Soluble in chlorhydric acid.

TUNGSTATE *of sesquioxide* OF URANIUM. In-
Ur_2O_3, WO_3 soluble in water. Soluble in strong acids, and in an aqueous solution of carbonate of ammonia. (Berzelius.)

TUNGSTATE OF VANADIUM. Slightly soluble in water.

TUNGSTATE OF YTTRIA. Very sparingly
$YrO, WO_3 + 2Aq$ soluble in water; rather more soluble in an aqueous solution of tungstate of soda. (Berzelius.)

TUNGSTATE OF ZINC. Insoluble in water.
ZnO, WO_3

TUNGSTEN. Unacted upon by any of the
W acids, by aqua-regia, or alkaline solutions. But is easily dissolved by a mixture of potash-lye and hypochlorite of soda. (Wœhler & v. Uslar.) None of the metallic compounds of tungsten are known to be soluble in alcohol.

TUNGSTIDE OF LEAD.

TUNGSTITE OF X. *Vid.* Tungstate of *X*, & of Tungsten.

TUNICIN. Insoluble in water, alcohol, ether,
$C_{12}H_{10}O_{10}$ or glacial acetic acid. (Berthelot.) Slowly soluble in concentrated nitric acid. (Schmidt.) Difficultly soluble in an aqueous solution of cupramin. (Schlossberger.) Unacted upon by boiling dilute acids, or by boiling potash-lye. (Berthelot.) Soluble in cold concentrated sulphuric acid. (Dumas.)

TURPENTINE. See under ESSENCES, & RESINS.

TURPETH MINERAL. *Vid. basic*Sulphate of Mercury ($3HgO, SO_3$). (Kane.)

TYROSIN. Very sparingly soluble in cold,

$$C_{18}H_{11}NO_6 = N\left\{\begin{matrix}C_{14}H_5O_2\\ C_2HO_2\\ C_2H_3\\ H\end{matrix}\right. . O, HO$$

tolerably soluble in boiling water.

Difficultly soluble in water. (Liebig.) Sparingly soluble in cold, abundantly soluble in hot water. (De la Rue; Hinterberger.) Less soluble than cucin in cold water. Soluble in 1900 pts. of water at 16°, and in 150 pts. of boiling water. Soluble in 13500 pts. of cold alcohol of 90%, and the solubility does not increase to any extent when the temperature is elevated. Insoluble in ether. (Stædeler, in *Kolbe's Lehrb.*, **2.** 307.) Insoluble in absolute alcohol. (Liebig.) Scarcely at all soluble in absolute alcohol (Bopp), more readily soluble when this contains acids or alkalies. (Strecker.) Insoluble in ether. (Hinterberger.) Readily soluble in alkaline solutions (Liebig); also in solutions of the alkaline earths, with combination in both cases. (Wicke.) Soluble, without decomposition, in ammonia-water, from which it is precipitated on the addition of alcohol. (De la Rue; Hinterberger.) Soluble, with combination, in concentrated sulphuric acid, in chlorhydric acid, and the mineral acids in general. Easily soluble, with decomposition, in nitric acid. Its solubility in water is not much augmented by the addition of acetic acid.

TYROSINBARIUM.

I.) Soluble in water.
$C_{18}H_{10}BaNO_6$

II.) Rather difficultly soluble in water. More
$C_{18}H_9Ba_2NO_6 + 4Aq$ abundantly soluble in cold than in hot water. Alcohol precipitates it from its aqueous solution.

TYROSINCALCIUM. Soluble in water.
$C_{18}H_9Ca_2NO_6$

TYROSINSILVER.

I.) Sparingly soluble in water. Easily soluble
$C_{18}H_{10}AgNO_6 + Aq$ in nitric acid and in ammonia-water.

II.) Difficultly soluble in water. Decomposed
$C_{18}H_9Ag_2NO_6 + 2Aq$ when boiled with water.

TYROSINSODIUM. Soluble in water.
$C_{18}H_9Na_2NO_6$

TYROSINSULPHURIC ACID.

I.) *Monobasic.*
$C_{18}H_{11}NS_2O_{12} = C_{18}H_{10}NO_5, HO, S_2O_6$

a = *Crystalline.* Exceedingly difficultly soluble in cold water, and only slowly soluble in boiling water. Boiling alcohol only dissolves traces of it. On the addition of chlorhydric or nitric acid, it is precipitated from the aqueous solution.

b = *Starchlike powder.* Much more readily soluble, both in water and ordinary spirit, than *a*. On the addition of strong chlorhydric acid to the aqueous solution *a* is precipitated. The salts of monobasic tyrosinsulphuric acid are generally soluble in water. (Stædeler.)

TyrosinSulphate of Ammonia. Soluble in water.
$C_{18} H_{10} (N H_4) N O_6, S_2 O_6 + 2 Aq$

TyrosinSulphate of Baryta. Soluble in water.
$C_{18} H_{10} Ba N O_6, S_2 O_6 + 4 Aq$

TyrosinSulphate of Lime. Soluble in water.
$C_{18} H_{10} Ca N O_6, S_2 O_6 + 5 Aq$

II.) *Bibasic.*
$C_{18} H_{11} N S_2 O_{12} = C_{16} H_9 N O_4, 2 H O, S_2 O_6$

***Di*TyrosinSulphate of Baryta.** Difficultly soluble in cold, tolerably abundantly soluble in boiling water.
$C_{18} H_9 Ba_2 N O_6, S_2 O_6 + 6 Aq$

U.

Ulmin. Of the products formed by the action of acids upon organic substances, as cellulose, sugar, gum, starch, &c., a portion is soluble in ammonia-water. Another portion "*ulmin*" is not soluble in ammonia-water, nor in solutions of the caustic alkalies. "*Ulmic acid*," when moist, is soluble in pure water, and in alkaline solutions, but is less soluble after having been strongly dried, or digested in concentrated chlorhydric acid. It is insoluble in acids, or in an aqueous solution of sulphate of potash; its compounds with copper and silver, are precipitates. For the ulmic products formed by the action of alkalies upon sugar, starch, gum, &c., see Melassic Acid; and for those formed by the putrefaction of organic matter, like the leaves and roots of plants, see Crenic Acid.
(*Ulmic Acid. Gein. Humic Acid. Geic Acid.*)

Umbellic Acid. *Vid.* Anisic Acid.

Uramilic Acid. *Vid.* Dialurate of Ammonia(*acid*).

Uramil. *Vid.* Dialuramid.

Uranic Acid. *Vid.* *Sesqui*Oxide of Uranium.

Uranate of Ammonia. Sparingly soluble in pure water. Easily soluble in an aqueous solution of sesquicarbonate of ammonia. Insoluble in ammonia-water, or in a weak aqueous solution of chloride of ammonium. (Compare Péligot, *Ann. Ch. et Phys.*, (3.) **5.** pp. 11, 45.)
$N H_4 O, 2 Ur_2 O_3 + Aq$

Uranate of Baryta. Insoluble in water. (Berzelius.)
$Ba O, 2 Ur_2 O_3$

Uranate of Cobalt. Insoluble in water. Soluble in an aqueous solution of basic acetate of lead. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.) Soluble in nitric acid. Insoluble in an aqueous solution of nitrate of potash. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 222.)

Uranate of Lead. When dried at 100°, it is readily soluble, with combination, in acetic acid; but after having been ignited, it is but difficultly soluble in acetic acid. (Wertheim, *Ann. Ch. et Phys.*, (3.) **11.** 69.) Uranate of lead is completely insoluble in an aqueous solution of basic acetate of lead. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.)
$Pb O, 2 Ur_2 O_3$

Uranate of Lime.

Uranate of Magnesia.
$Mg O, 2 Ur_2 O_3$

Uranate of Nickel. Insoluble in water. Soluble in an aqueous solution of basic acetate of lead. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.)

Uranate of Potash. Insoluble in, and unacted upon by, boiling water. (Berzelius, *Lehrb.*) Insoluble in an aqueous solution of monocarbonate of potash, but readily and completely soluble in solutions of the alkaline bicarbonates, with combination. Soluble in chlorhydric acid. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** pp. 220, 204.)
$K O, 2 Ur_2 O_3$

Uranate of Silver. Ppt.
$Ag O, 2 Ur_2 O_3$

Uranate of Soda.
$Na O, 2 Ur_2 O_3$

Uranate of Zinc. Insoluble in water. Soluble in an aqueous solution of basic acetate of lead. (Persoz, *J. pr. Ch.*, 1834, **3.** 216.) Soluble in nitric acid. Insoluble in an aqueous solution of nitrate of potash, or of nitrate of ammonia. (Ebelmen, *Ann. Ch. et Phys.*, (3.) **5.** 221.)

Uranium. Permanent. Unacted upon by water at the ordinary temperature. Easily soluble in dilute acids. (Péligot, *Ann. Ch. et Phys.*, (3.) **5.** pp. 19, 20.)
Ur

Uric Acid. Permanent. Almost insoluble in cold, sparingly soluble in warm water. Soluble in 14000 @ 15000 pts. of water at 20° (Bensch); in 10000 pts. of cold water (Proust); in 5000 pts. of cold water (Du Menil); in 2800 pts. of cold water (Gœbel); in 1720 pts. of cold water (W. Henry); in 1800 @ 1900 pts. of boiling water (Bensch); in 1300 pts. of boiling water (Du Menil); in 1400 pts. of boiling water (W. Henry); in 760 pts. of boiling water (Gœbel); in 500 pts. of boiling water (Pearson); and in 300 pts. of boiling water. (Scheele.)
(*Lithic Acid. Lithic Oxide. Harnsæure.*)
$C_{10} H_4 N_4 O_6 + 4 Aq$

Difficultly soluble in boiling water, but dissolves somewhat readily in hot aqueous solutions of several salts containing weak acids, like the alkaline acetates, for example, — the acetic acid being set free, to a certain extent, while the uric acid combines with the alkali; on cooling, however, nearly pure uric acid separates out. (Lipowitz, *Ann. Ch. u. Pharm.*, **38.** 350.) It dissolves readily in the alkaline carbonates, borates, phosphates, lactates, and acetates, since it abstracts some of the alkali from these salts, and is thus rendered more soluble. (Lehmann's *Physiol. Chem.*)

Soluble, with combination, in aqueous solutions of the caustic alkalies. Insoluble in a concentrated solution of carbonate of potash; but it dissolves sparingly in a solution of 1 pt. of carbonate of potash in 8 pts. of water, being soon converted into acid urate of potash; it is more quickly dissolved by a solution of 1 pt. $K O, C O_2$ in 24 pts. of water, and in this case a considerable quantity of the acid urate remains in solution. It is rapidly soluble in a solution of 1 pt. $K O, C O_2$ in 100 @ 200 pts. of water. (Weltzar.) At the temperature of boiling, a solution of 1 pt. of mono- or bicarbonate of potash or soda in 90 pts. of water dissolves 2 pts. of uric acid, carbonic acid being meanwhile evolved; the alkaline urate thus formed crystallizes out on cooling. After having become dry, however, the alkaline urates are difficultly soluble in water. The best method of obtaining the above-mentioned solution is to dissolve, in the first place, the alkaline carbonate in boiling water, and then add the uric acid; for if a mixture of uric acid and the carbonate, especially carbonate of soda, be treated with water, and the whole then heated, only a little of the urate will be dissolved, the greater portion of it remaining suspended in the liquor, an insoluble acid salt and a soluble basic salt being apparently formed. At lower temperatures very much more of the alkaline carbonate is required in order to dissolve uric acid, no carbonic acid being evolved in this case, a compound being formed directly from the acid and carbonate. (Lipowitz, *Ann. Ch. u. Pharm.*, **38.** 349.) A mixture of 1 pt. of uric acid and 1 pt. of carbonate of lithia dissolves easily in 90 pts. of water at a temperature of about 50°, and the solution remains perfectly clear on cooling. At the temperature of boiling, 1 pt. of the lithia in 90 pts. of water dissolves almost 4 pts. of uric acid, much carbonic acid being evolved; and, on cooling, a gelatinous mass separates, which, however, dissolves very easily when the liquor is again heated. Caustic lithia dissolves about 6 pts. of uric acid. (Lipowitz, *Ann. Ch. u. Pharm.*, **38.** 352; compare v. Schilling, *Ann. Ch. u. Pharm.*, 1862, **122.** 241.)

Soluble in an aqueous solution of borax, especially when this is dilute. (Bœttger.) Soluble in an aqueous solution of biborate of soda, though to a less extent than in the alkaline carbonates, a solution of 1 pt. of borax in 90 pts. of water being able to dissolve no more than 1 pt. of uric acid; this solution occurs, however, as Bœttger has already shown, at a temperature lower than that of boiling. On cooling this solution most of the uric acid separates out as a compound of uric acid and soda. A solution of borax mixed with boracic acid dissolves the same quantity of uric acid as the solution of simple borax, but on cooling this solution the uric acid separates out completely in combination with soda. (Lipowitz, *loc. cit.*, p. 350.)

Very readily soluble in a warm aqueous solution of ordinary phosphate of soda ($2 Na O, H O, P O_5$). (Liebig.) Soluble in an aqueous solution of phosphate of soda. When the diphosphate of soda is somewhat basic, as is usually the case, it dissolves at the temperature of boiling no inconsiderable quantity of uric acid, a compound of uric acid and soda being deposited as the solution cools, though some uric acid still remains in solution. An acid solution of phosphate of soda dissolves less uric acid, and, moreover, deposits all of it, as a soda salt, on cooling. (Lipowitz, *Ann. Ch. u. Pharm.*, **38.** 351.)

For experiments on the solubility of uric acid in various saline solutions, see Ure, in *J. Ch. Méd.*, **18.** 63.

Insoluble in alcohol, or ether. Almost insoluble in dilute acids. Soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water. (Weltzar; Dœbereiner.) Somewhat more readily soluble in concentrated chlorhydric acid than in water.

Soluble in an aqueous solution of cane-sugar, and may be reprecipitated therefrom by adding chlorhydric acid. (Vasmer.) The observed solubility of uric acid in aqueous solutions of the fermentable sugars is very insignificant, but, on the other hand, its solubility in solutions of the nonfermentable sugars is not inconsiderable; a tolerably dilute and warm solution of glycerin in particular dissolving a considerable quantity of it, but on cooling this solution the greater part of the uric acid is again deposited. Mannite also dissolves a portion of it, but not so much as glycerin. (Lipowitz, *Ann. Ch. u. Pharm.*, **38.** 355.) Insoluble in creosote. (Reichenbach.)

The urates of the fixed alkalies and alkaline earths are difficultly soluble in cold, but more easily soluble in hot water; those of the other metallic oxides, and the ammonia-salt are insoluble. All of the urates are decomposed by acids even by acetic acid.

Urate of Ammonia.

I.) *acid.* Soluble in 1608 pts. of water at 15°; more abundantly soluble in hot water. (Bensch.) Sparingly soluble in ammonia-water. Soluble in 480 pts. of water. (Proust.)

$C_{10} H_3 (N H_4) N_4 O_6$

Urate of Ammonia & of Glycocoll. Soluble in hot water, less soluble in cold water; and still less soluble in alcohol. (Horsford, *Am. J. Sci.*, (2.) **4.** 69.)

“$N H_4 O, C_5 H_2 N_2 O_3; C_4 H_4 N O_3, C_5 H_2 N_2 O_3$”

Urate of Baryta.

I.) *normal.* Soluble in 7900 pts. of cold water, and in 2700 pts. of boiling water. (Allan & Bensch.)

$C_{10} H_2 Ba_2 N_4 O_6 + 4 Aq$

II.) *acid.* Insoluble in water, alcohol, or ether. (Bensch.) Sparingly soluble in water. (Wetzlar; Kodweis.)

$C_{10} H_3 Ba N_4 O_6 + 2 Aq$

Urate of Cinchonin. Sparingly soluble in water, or in boiling alcohol, or ether. (Elderhorst.)

$C_{10} H_3 \left(N_2 \left\{ C_{40} H_{24} O_2^{vi} . H \right) N_4 O_6 + 8 Aq \right.$

Urate of Copper.

I.) *basic.* Ppt.

$C_{10} H_2 Cu_2 N_4 O_6 ; Cu O + 5 Aq$

Urate of Lead.

I.) *normal.*

$C_{10} H_2 Pb_2 N_4 O_6$

II.) *acid.*

$C_{10} H_3 Pb N_4 O_6 + 2 Aq$

Entirely insoluble in water or alcohol. (Allan & Bensch.)

Urate of Lime.

I.) *normal.* Soluble in 1500 pts. of cold, and in 1440 pts. of boiling water. Soluble in a hot aqueous solution of chloride of calcium. (Allan & Bensch.)

$C_{10} H_2 Ca_2 N_4 O_6$

II.) *acid.* Soluble in 603 pts. of cold, and in 276 pts. of boiling water. Much more readily soluble in an aqueous solution of chloride of potassium. (Bensch.)

$C_{10} H_3 Ca N_4 O_6 + 3 Aq$

Urate of Lithia.

I.) *acid.* When not too strongly dried, it is easily soluble in 60 pts. of water at 50°, and does not separate out again as the solution cools. When completely dried at a higher temperature, it becomes proportionably less soluble in water, like the other alkaline urates, but still remains, in any event, the most soluble of any of the urates. (Lipowitz, *Ann. Ch. u. Pharm.*, 1841, **38.** 352.)

$C_{10} H_3 Li N_4 O_6$

When dried at 100°, one pt. of it is

soluble in	367.82	pts. of water at	20° (about)
“	115.79	“	39°
“	38.97	“	boiling.

Soluble in alcohol, but may be washed with alcohol. (v. Schilling, *Ann. Ch. u. Pharm.*, 1862, **122.** pp. 244, 242.)

Urate of Magnesia.

I.) *acid.* Soluble in 3500 @ 4000 pts. of cold, and in 150 @ 170 pts. of boiling water. (Bensch.)

$C_{10} H_3 Mg N_4 O_6 + 6 Aq$

Urate of Mercury ($Hg O$).

I.) *acid.* Ppt.

Urate of Morphine. Soluble in boiling, less soluble in cold water.

Urate of Potash.

I.) *normal.* $C_{10}H_2K_2N_4O_6$ Soluble in 44 pts. of cold, and in 30 @ 40 pts. of boiling water.

Soluble in 36 pts. of water at 15°, with partial decomposition. Sparingly soluble in alcohol. Insoluble in ether. (Allan & Bensch.) Soluble in potash-lye, from which solution carbonic acid precipitates the acid salt.

II.) *acid.* $C_{10}H_3KN_4O_6$ Soluble in 780 @ 800 pts. of water at 20°, and in 70 @ 80 pts. of boiling water. (Bensch.) Insoluble in alcohol or ether. Much less soluble in an aqueous solution of carbonate of potash than in pure water. (Compare Uric Acid.)

Urate of Quinine. Soluble in boiling, or even in warm water. Less readily soluble in cold water.

Urate of Sarcin. Tolerably easily soluble

$$C_{20}H_8N_8O_8 = C_{10}H_8\left(N_2\left\{\begin{matrix}C_6H_2''\\(C_2N)_2 . HO_2\\H_2\end{matrix}\right.\right)N_4O_6$$

in water. Decomposed by acids. (Strecker.)

Urate of Silver. Ppt.

Urate of Soda.

I.) *normal.* $C_{10}H_2Na_2N_4O_6 + 2\,Aq$ Soluble in 77 pts. of cold, and in 75 pts. of boiling water; in 80 @ 90 pts. of boiling water.

Soluble in 62 pts. of water at 15°, with partial decomposition. (Allan & Bensch.) Very sparingly soluble in alcohol. Insoluble in ether. Carbonic acid precipitates the acid salt from its solution in alkalies.

II.) *acid.* Soluble in 1100 @ 1200 pts. of water at 15°, and in 123 @ 125 pts. of boiling water. (Bensch.) Very much less soluble in an aqueous solution of carbonate of soda than in pure water. (Welzlar.)

Urate of Strontia.

I.) *normal.* $C_{10}H_2Sr_2N_4O_6 + 4\,Aq$ Soluble in 4300 pts. of cold, and in 2297 (1790?) pts. of boiling water. (Allan & Bensch.)

II.) *acid.* Soluble in 603 pts. of cold, and in 276 pts. of boiling water; in 2300 pts. of hot, and in 5300 pts. of cold water. Insoluble in alcohol or ether.

Urea. (*Carbamid. Harnstoff.* Isomeric with Cyanate of Ammonia.) $C_2H_4N_2O_2 = N_2\left\{\begin{matrix}C_2O_2''\\H_4\end{matrix}\right.$ Soluble in less than 1 pt. of water at 15°, with reduction of temperature, and in all proportions in water at 100°. (Prout.) A dilute aqueous solution undergoes decomposition in time, when left to itself; also more rapidly when boiled, but a concentrated solution may be preserved unchanged.

Soluble in 1 pt. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, 8. 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)

Soluble in 5 pts. of cold alcohol of 0.816 sp. gr., and in less than 1 pt. of boiling alcohol (Prout); in 4 @ 5 pts. of cold, and in 2 pts. of boiling alcohol. Ether only dissolves traces of it. (Wittstein's *Handw.*) Very sparingly soluble in ether. Insoluble in oil of turpentine.

Most of the salts of urea are soluble in alcohol.

UreoCarbonic Acid. $C_4H_4N_2O_6$ *Vid.* Allophanic Acid.

Ureous Acid. *Vid.* Xanthic Oxide.

Uret. $N\left\{\begin{matrix}C_2O_2''\\H_3\end{matrix}\right.$

***Bi*Uret.** $C_4H_5N_3O_4 = N_3\left\{\begin{matrix}(C_2O_2'')_2\\H_5\end{matrix}\right.$ Easily soluble in water, and still more readily in alcohol. Soluble, without decomposition, in concentrated sulphuric and nitric acids. (Wiedemann.)

Urethamylane. *Vid.* Carbamate of Amyl.

Urethan. *Vid.* Carbamate of Ethyl.

Urethane*Sulfuré*. *Vid.* Hydrate of SulphoCarbonylEthylammonium.

Urethylan. *Vid.* Carbamate of Methyl.

Uroerythrin. Insoluble in alcohol or ether, even when these are acidulated.

Uroglaucin(of Heller). (*Urocyanin*(of Martin).) Permanent. Insoluble in water, cold alcohol, or ether. Difficultly soluble in hot alcohol. (Heller.)

Urorhodin. Insoluble in water. Soluble in cold alcohol of 0.830 sp. gr., and in ether. (Heller.)

Uroxanic Acid. $C_{10}H_{10}N_4O_{12}$ Sparingly soluble in cold water; more abundantly soluble, with decomposition, in boiling water. Readily soluble in ammonia-water.

Uroxanate of Ammonia. Soluble in water. Sparingly soluble in alcohol.

Uroxanate of Baryta. Soluble in water, from which it is precipitated on the addition of alcohol.

Uroxanate of Lead. Insoluble in water.

Uroxanate of Lime. Soluble in water, from which it is precipitated on the addition of alcohol.

Uroxanate of Potash. $C_{10}H_8K_2N_4O_{12} + 6\,Aq$ Very easily soluble in hot, and quite readily soluble in cold water. Insoluble in alcohol.

Uroxanate of Silver. Ppt.

Uroxin. *Vid.* Alloxantin.

Ursin. Soluble in water, alcohol, ether, and dilute acids. (Parrish's *Pharm.*, pp. 422, 426.)

Ursone. $C_{20}H_{17}O_2$ Insoluble in water, dilute acids, or alkaline solutions. Difficultly soluble in alcohol, and ether.

Usnic Acid. (*Usnein. Parietin*(of Thomson).) $C_{38}H_{16}O_{14} = C_{38}H_{15}O_{13}, HO$ Insoluble in water. Very sparingly soluble in boiling spirit; but soluble in hot concentrated alcohol. Slowly soluble in cold, easily soluble in boiling ether. Soluble in oil of turpentine, and the fatty oils. Insoluble in chlorhydric acid. Soluble in concentrated sulphuric acid, from which it is precipitated on the addition of water. Easily soluble in concentrated aqueous solutions of the alkalies. With the exception of the alkaline salts, most of the usnates are insoluble in water; but they dissolve in alcohol; ether decomposes them.

Usnate of Ammonia. Soluble in water, and alcohol.

Usnate of Baryta. $C_{38}H_{15}BaO_{14}$ Easily soluble in alcohol.

Usnate *of protoxide* of Copper. $C_{38}H_{15}CuO_{14}$ Ppt.

Usnate of Lead. Ppt.

Usnate of Potash. $C_{38}H_{15}KO_{14}$ Difficultly soluble in water; the aqueous solution being decomposed on the addition of much water, with separation of an insoluble acid salt. Soluble in spirit.

Usnate of Silver. Ppt.

Usnate of Soda. Soluble in water, and alcohol.

Uvic Acid. *Vid.* ParaTartaric Acid.

V.

Vaccinic Acid. Not isolated.
$C_{20}H_{20}O_6 = C_{20}H_{18}O_4, 2HO$

Vaccinate of Baryta. Efflorescent. Soluble in water. (Lerch.)
$C_{20}H_{18}Ba_2O_6$

Valene. *Vid.* Valerol.

ValerAcetoNitril(of Schlieper). Much more soluble than ether in water. Miscible in all proportions in alcohol, and ether. (Schlieper.)
$C_{26}H_{24}N_2O_6$

Valeral. *Vid.* Hydride of Valeryl.

Valeraldid. *Vid.* Hydride of Valeryl.

ValeraldidAmmonia. *Vid.* Valerylide of Ammonia.

Valeraldin. Insoluble in water. Soluble in alcohol, and ether. (Beissenhirtz, *Ann. Ch. u. Pharm.*, **90.** 109.)
$C_{30}H_{31}NS_4$

Valeramid. Very easily soluble in water.
(*Valerylamid.*)
$C_{10}H_{11}NO_2 = N\left\{\begin{matrix}C_{10}H_9O_2\\H_2\end{matrix}\right.$

Valeramin. *Vid.* Amylamin.

ValerAnilid. *Vid.* PhenylValeramid.

Valeric, or Valerianic Acid(Anhydrous).
(*Valeric Valerate. Valeric Anhydride.*)
$C_{20}H_{18}O_6 = \left.\begin{matrix}C_{10}H_9O_2\\C_{10}H_9O_2\end{matrix}\right\}O_2$
Slowly combines with water when exposed to moist air. This transformation is more rapid, though still slow, in warm water; but very rapid in a boiling aqueous solution of caustic potash. Alcohol also decomposes it; but it is soluble, without decomposition, in ether. (Chiozza, *Ann. Ch. et Phys.*, (3.) **39.** pp. 197, 198.)

Valeric Acid. Soluble in 16 pts. of cold water (Grote); in 20 pts. of cold water (Wittstein); in 30 pts. of water at 18.2° (Chevreul); in 30 pts. of water at 12° (Trommsdorff), the solution containing 3.22% of it; in 30 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)
(*Valerianic Acid. Baldrianic Acid. Delphinic Acid. Phocenic Acid.*)
$C_{10}H_{10}O_4 = C_{10}H_9O_3, HO, \& + 2Aq$

Miscible in all proportions with alcohol, of 0.794 sp. gr., ether (Chevreul), and oil of turpentine. (Trautwein.) Partially soluble in oil of turpentine. (Grote.) Insoluble in oil of turpentine, or in olive-oil. (Trommsdorff.) Readily soluble in large quantity in acetic acid of 1.07 sp. gr. (Trommsdorff.) Soluble in concentrated sulphuric acid, from which it is partially precipitated on the addition of water. Sparingly soluble in cold nitric acid. (Chevreul.)

Many of the valerates are soluble in water, and some of them in alcohol also. (Trautwein.)

Valerate of Allyl. Insoluble in water. Readily soluble in alcohol, and ether. (Hofmann & Cahours, *J. Ch. Soc.*, **10.** 322.)
$C_{16}H_{14}O_4 = C_{10}H_9(C_6H_5)O_4$

Valerate of Alumina. Boiling water dissolves only a trace of it. Insoluble in alcohol. Very sparingly soluble in valeric acid. (Trommsdorff.)

Valerate of Ammonia. Readily soluble in water, and alcohol. (Trautwein.) Very deliquescent and soluble in water. (Chevreul.)

Valerate of Amyl. Soluble in alcohol.
(*Apple Oil.*)
$C_{20}H_{20}O_4 = C_{10}H_9(C_{10}H_{11})O_4$

Valerate of Atropin. Very soluble in water; but this solution, neutral at first, becomes acid when evaporated. Its solution is decomposed when heated above 50°. Decomposed by acids, even the weakest. (Miette, *C. R.*, 1857, **45.** 1053.) Extremely soluble in water; less soluble in alcohol, and still less soluble in ether. (Callman, *C. R.*, 1858, **47.** 417.)
$C_{10}H_9(NC_{34}H_{23}O_6 . H)O_4 + Aq$

Valerate of Baryta. Efflorescent. Soluble in 2 pts. of water at 15°, and in 1 pt. of water at 20°. (Chevreul.) Difficultly soluble in absolute alcohol. (Schlieper.)
$C_{10}H_9BaO_4 + 2Aq$

Valerate of Benzol. Soluble in ether. (Wicke.)
$C_{34}H_{24}O_8 = C_{20}H_{18}(C_{14}H_6'')O_8$

Valerate of Benzoyl. *Vid.* BenzoValeric Acid.

Valerate of Bismuth. Neither dissolved nor decomposed by cold or boiling water. (Wittstein.)
$3BiO_3, 2C_{10}H_9O_3 + 4Aq$

Valerate of Butyl.
$C_{18}H_{18}O_4 = C_{10}H_9(C_8H_9)O_4$

Valerate of Cadmium. Soluble in water, and alcohol. (Bonaparte.)

Valerate of Cerium. Ppt.

Valerate of Cinchonidin(of Pasteur). Soluble in water, and spirit. (Leers, *Ann. Ch. u. Pharm.*, **82.** 161.)

Valerate of Cinchonin.

Valerate of Cobalt. Permanent. Readily soluble in water, and alcohol. (Trommsdorff.)

Valerate of Copper(Cu O). Easily soluble in water, and alcohol. (Trommsdorff.)
$C_{10}H_9CuO_4 + Aq$

Valerate of Didymium. Soluble in water. (Bonaparte.)

Valerate of Ethyl. Insoluble in water. Very easily soluble in alcohol, ether, and the oils. (Grote & Otto.)
$C_{14}H_{14}O_4 = C_{10}H_9(C_4H_5)O_4$

Valerate of Glucina. Permanent. Soluble in water. (Trommsdorff.)

Valerate of Glyceryl. *Vid.* Valerin.

Valerate *of protoxide* **of Iron.** Somewhat soluble in water.

Valerate *of sesquioxide* **of Iron.** Insoluble in cold, gradually decomposed by hot water. Soluble in alcohol. Readily soluble in chlorhydric and other acids. (Wittstein.)
$C_{30}H_{27}Fe_2'''O_{12}$

Valerate of Lead.

I.) *normal.* Readily soluble in water. (Trommsdorff.)
$C_{10}H_9PbO_4$

II.) *basic.* Sparingly soluble in water. (Chevreul.)
$C_{10}H_9PbO_4, 2PbO$

Valerate of Lime. Effloresces in warm air. Readily soluble in water, and in boiling hydrated alcohol. Sparingly soluble in absolute alcohol. (Trommsdorff.)
$C_{10}H_9CaO_4$

Valerate of Lithia. Soluble in water.
$C_{10}H_9LiO_4 + 2\,Aq$

Valerate of Magnesia. Effloresces in warm air. Tolerably soluble in water. Sparingly soluble in alcohol. (Trommsdorff.)

Valerate of Manganese. Readily soluble in water. (Trommsdorff.)

Valerate *of dinoxide* **of Mercury.**

Valerate *of protoxide* **of Mercury.** Insoluble in cold, soluble in boiling water. (Trommsdorff.)

Valerate of Methyl.
$C_{12}H_{12}O_4 = C_{10}H_9(C_2H_3)O_4$

Valerate of Morphine.

Valerate of Nickel.

I.) Readily soluble in boiling water.

II.) Sparingly soluble in boiling water. Soluble in alcohol. (Trommsdorff.)

Valerate of Potash. Very deliquescent.
$C_{10}H_9KO_4$ Readily soluble in water, and alcohol. Soluble in less than 3.9 pts. of alcohol, of 0.792 sp. gr., at 20°. (Chevreul.)

Valerate of Quinine.

I.) *amorphous.* Scarcely soluble in 1000 pts. of water. Easily soluble in alcohol, and ether. (Wittstein.)
$2\left(N_2\left\{C_{40}H_{24}O_4^{\mathrm{VI}}\right.\right), C_{10}H_{10}O_4 + 4\,Aq$

II.) *crystalline.* Permanent. Soluble in 110 pts. of cold, and in 40 pts. of boiling water. Soluble in 6 pts. of cold or boiling alcohol of 80%. Very easily soluble in ether. When the aqueous solution is evaporated at a temperature superior to 50°, the pitch-like, difficultly soluble, amorphous hydrate separates out, instead of crystals. (Wittstein.)
$2\left(N_2\left\{C_{40}H_{24}O_4^{\mathrm{VI}}\right.\right), C_{10}H_{10}O_4 + 24\,Aq$

1 pt. of valerate of quinine is soluble in 96 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 75.)

Valerate of Silver. Very insoluble in water. (Lehmann's *Physiol. Chem.*) Soluble in water. (Ettling.) May be washed with cold water. (Gerhardt.)
$C_{10}H_9AgO_4$

Valerate of Soda. Extremely deliquescent. Easily soluble in water, and in alcohol, even when this is absolute. (Chevreul.)

Valerate of Strontia. Efflorescent. Very readily soluble in water, and alcohol. (Chevreul.)

Valerate *of protoxide* **of Uranium.** Ppt.

Valerate *of sesquioxide* **of Uranium.** Readily soluble in water, alcohol, and ether. (Buonaparte.)

Valerate of Zinc. Permanent. Soluble in 50 [5.0 in Gmelin] pts. of cold, and in 40 pts. of boiling water. (Duclou.) Soluble in 96 pts. of water at 18.75°. (Abl, from *Œsterr. Zeitschrift für Pharm.*, **8.** 201, in *Canstatt's Jahresbericht für* 1854, p. 76.)
$C_{10}H_9ZnO_4$

In an earlier memoir, Wittstein states that 1 pt. of the anhydrous salt is soluble in 160 pts. of cold water, but he subsequently corrected this, saying that 90 pts. of water will dissolve 1 pt. of the salt. This observer also obtained a salt containing 12 equivalents of water of crystallization, which is soluble in only 44 pts. of water. (Wittstein's *Handw.*)

Soluble in 60 pts. of cold alcohol of 80%. These cold solutions become turbid on being heated, clearing up again on cooling, hence its solubility in water, and alcohol, diminishes as the temperature rises. On the other hand, it is soluble in 500 pts. of cold, and in 20 pts. of boiling ether. (Wittstein.) Soluble in 17.4 [14.5 in *Gm.*] pts. of cold, and in 16.7 pts. of boiling alcohol. (Duclou.)

The aqueous solution is decomposed by prolonged ebullition to an insoluble basic, and a soluble acid, salt.

Valerate of Zirconia. Partially soluble in water. Soluble in valeric acid. (Trommsdorff.)

Valerene. *Vid.* Amylene; also Borneene.

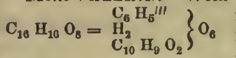
Valeriamylic Acid. *Vid.* Valerate of Amyl.

Valerianic Acid. *Vid.* Valeric Acid.

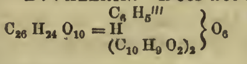
Valerianic Aldehyde. *Vid.* Hydride of Valeryl.

Valeric Anhydride. } *Vid.* Valeric Acid
Valeric Valerate. } (Anhydrous).

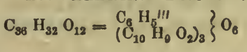
*Mono***Valerin.** With ½ a volume of water it forms a limpid mixture, from which it separates completely on the addition of another ½ volume of water. 8 or 10 volumes of water precipitate the limpid mixture in a similar manner, but with 100 volumes of water it forms a solution, or rather, an emulsion. (Berthelot.)


$$C_{16}H_{16}O_8 = \left.\begin{matrix} C_6H_5^{\prime\prime\prime} \\ H_2 \\ C_{10}H_9O_2 \end{matrix}\right\} O_6$$

*Di***Valerin.** Does not form a limpid mixture with ½ a volume of water; but with 8 @ 10 volumes of water it forms an emulsion, from which the divalerin soon separates, however. It is not soluble, even in a large amount of water. (Berthelot.)


$$C_{26}H_{24}O_{10} = \left.\begin{matrix} C_6H_5^{\prime\prime\prime} \\ H \\ (C_{10}H_9O_2)_2 \end{matrix}\right\} O_6$$

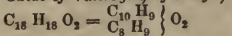
*Tri***Valerin.** Insoluble in water. Soluble in alcohol, and ether. (Berthelot, *Ann. Ch. et Phys.*, (3.) **41.** 253.) According to Berthelot, the "delphinin" ("phocenin," "valerin") of Chevreul is a mixture of the three valerins. It dissolves abundantly in hot alcohol. (Chevreul.)


$$C_{36}H_{32}O_{12} = \left.\begin{matrix} C_6H_5^{\prime\prime\prime} \\ (C_{10}H_9O_2)_3 \end{matrix}\right\} O_6$$

Valero*di***Chlorhydrin.** Insoluble in water.
$C_{16}H_{14}Cl_2O_4$ (Berthelot.)

Valerol. Sparingly soluble in water. Readily soluble in alcohol, ether, and the essential oils. Also soluble in concentrated sulphuric acid; on adding water to this solution a portion of the valerol is precipitated, but a portion remains combined with the acid. Unacted upon by cold, decomposed by warm nitric acid. (Gerhardt, *Ann. Ch. et Phys.*, (3.) **7.** 278.)
$C_{12}H_{10}O_2$

Valerone. Insoluble in water. Readily soluble in alcohol, and ether.
(*Valene. Valerylide of Butyl. Oxide of Valeroyl & of Butyl.*)

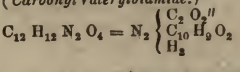

$$C_{18}H_{18}O_2 = \left.\begin{matrix} C_{10}H_9 \\ C_8H_9 \end{matrix}\right\} O_2$$

ValeroNitril. *Vid.* Cyanide of Butyl.

Valerylide of Ammonium. *Vid.* Oxide of Ammonium & of Valeroyl.

Valerylide of Butyl. *Vid,* Valerone.

Valeryl Urea. Almost insoluble in cold, somewhat soluble in boiling water. Almost insoluble in alcohol. (Moldenhauer, *Ann. Ch. u. Pharm.*, **94.** 102.)
(*Carbonyl Valerylbiamide.*)


$$C_{12}H_{12}N_2O_4 = N_2\left\{\begin{matrix} C_2O_2^{\prime\prime} \\ C_{10}H_9O_2 \\ H_2 \end{matrix}\right.$$

Valyl. *Vid.* Butyl.

Vanadic Acid. VO_3 Slightly soluble in water, requiring about 1000 pts. of boiling water for its solution. (Berzelius.) Less soluble in water than molybdic acid. Insoluble in absolute alcohol. Sparingly soluble in alcohol of 0.80 sp. gr. Insoluble in glacial acetic acid. Readily soluble in the stronger acids. Very slightly soluble in formic acid. (Berzelius.) When the solution in strong mineral acids is diluted with water, and then boiled, vanadic acid separates out. (H. Rose, *Pogg. Ann.*, **83**. 151.) Easily reduced by red nitric acid, sulphurous acid, several organic acids, especially oxalic and tartaric acids, sugar, alcohol, etc., when gently heated therewith. Soluble in chlorhydric acid, with subsequent decomposition and evolution of chlorine. (Berzelius, *Lehrb.*) Most of the bivanadiates are readily soluble in water, but they dissolve less easily in aqueous solutions of the caustic alkalies, chloride of ammonium, and other salts; they are all insoluble in alcohol. The other vanadiates are but sparingly soluble in water, and insoluble in alcohol.

Vanadiate of Alumina. $Al_2O_3, 3VO_3$ Somewhat soluble in water. But less soluble than the glucina salt.

Vanadiate of Ammonia.

I.) *White modification.* NH_4O, VO_3 Soluble in boiling, sparingly and very slowly soluble in cold water. Insoluble in alcohol, and only slightly soluble in a saturated aqueous solution of chloride of ammonium.

II.) *Yellow modification.* Soluble in water, from which it is precipitated on the addition of alcohol.

III.) *bi.* $NH_4O, 2VO_3$ Soluble in water, from which it is precipitated on the addition of alcohol.

Vanadiate *of teroxide* **of Antimony.** Soluble in an aqueous solution of tartar-emetic. (Prideaux.)

Vanadiate of Baryta.

I.) *mono.* $BaO, VO_3 + 3Aq$ Before ignition it is sparingly soluble in water. Soluble in concentrated sulphuric acid.

II.) *bi.* $BaO, 2VO_3$ Rather difficultly soluble in water; and still less soluble in alcohol.

III.) *basic.* Insoluble, or very sparingly soluble, in water.

Vanadiate of Cadmium.

I.) *mono.* CdO, VO_3 Somewhat soluble.

II.) *bi.* Soluble in water. (Berzelius.)

Vanadiate of Cobalt.

I.) *mono.* CoO, VO_3 Insoluble in water.

II.) *bi.* Soluble in water. Insoluble in alcohol. (Berzelius.)

Vanadiate *of protoxide* **of Copper.**

I.) *mono.* CuO, VO_3 Soluble in water. Insoluble in alcohol.

II.) *bi.* $CuO, 2VO_3$ Soluble in water. (Berzelius.)

III.) *basic.* Insoluble in water. Soluble in chlorhydric and nitric acids. (Hess.)

Vanadiate of Glucina.

I.) *normal.* $Gl_2O_3, 3VO_3$ } Both are sparingly soluble in water.
II.) *acid.* }

Vanadiate *of protoxide* **of Iron.**

I.) Ppt. FeO, VO_3 Soluble in chlorhydric acid.

II.) *acid.* Ppt.

Vanadiate *of sesquioxide* **of Iron.**

I.) *normal.* $Fe_2O_3, 3VO_3$ Slightly soluble in water. (Berzelius.)

II.) *acid.* Ppt.

Vanadiate of Lead.

I.) *mono.* PbO, VO_3 Slightly soluble, with decomposition, in water. Easily soluble in cold, or slightly warmed, dilute nitric acid. (Berzelius.)

II.) *bi.* $PbO, 2VO_3$ Slightly soluble in water. (Berzelius.)

Vanadiate of Lime.

I.) *mono.* CaO, VO_3 More soluble in water than the strontia salt. Somewhat soluble in alcohol.

II.) *bi.* $CaO, 2VO_3$ Permanent. Very readily soluble in water.

III.) *basic.*

Vanadiate of Lithia.

I.) *mono.* LiO, VO_3 Very soluble in water.

II.) *bi.* $LiO, 2VO_3$ Efflorescent. Soluble in water. Insoluble in absolute alcohol, but somewhat soluble in ordinary alcohol.

Vanadiate of Magnesia.

I.) *mono.* MgO, VO_3 Very soluble in water; being as readily soluble as the normal salts of the fixed alkalies.

II.) *bi.* $MgO, 2VO_3$ Less soluble in water than the mono-salt (No I.). Alcohol precipitates it, in great part, from the aqueous solution. (Berzelius, *Lehrb.*)

Vanadiate of Manganese.

I.) *mono.* MnO, VO_3 Sparingly soluble in cold, more readily soluble in hot water. Insoluble in alcohol. (Berzelius.)

II.) *bi.* $MnO, 2VO_3$ Difficultly soluble in cold water. Insoluble in alcohol. (Berzelius.)

Vanadiate *of dinoxide* **of Mercury.**

I.) *mono.* Hg_2O, VO_3 Soluble.

II.) *bi.* Ppt.

Vanadiate *of protoxide* **of Mercury.**

I.) *mono.* HgO, VO_3 Slightly soluble in water.

II.) *bi.* $HgO, 2VO_3$ Soluble in water, and alcohol. (Berzelius.)

Vanadiate of Nickel.

I.) *mono.* NiO, VO_3 Soluble in water. Insoluble in alcohol.

II.) *bi.* $NiO, 2VO_3$ Soluble in water, and in ammonia-water. Insoluble in alcohol. (Berzelius.)

Vanadiate of Potash.

I.) *mono.* KO, VO_3 Very soluble in water, though dissolving very slowly in cold water. In boiling water it dissolves more rapidly. (Berzelius, *Lehrb.*, **3**. 184) Still more difficultly soluble in a cold aqueous solution of caustic potash than in pure water. [*Gm.*]

II.) *bi.* $KO, 2VO_3$ Sparingly soluble in cold, much more soluble in boiling water. When treated with a small quantity of hot water, this dissolves out some KO, VO_3, and some $KO, 2VO_3$, leaving undissolved an acid salt; this behavior is more strongly marked, if the salt has been fused or dehydrated before treating it with the hot water. Insoluble in alcohol.

III.) *peracid.* Insoluble in water.

VANADIATE OF SILVER.
I.) *mono.* Ppt.
AgO, VO_3
II.) *bi.* Slightly soluble in cold, more readily
$AgO, 2VO_3$ soluble in hot water. Easily soluble in dilute nitric acid; also soluble, with combination, in very dilute ammonia-water. (Berzelius.)

VANADIATE OF SODA.
I.) *mono.* Soluble in water.
NaO, VO_3
II.) *bi.* Efflorescent. More soluble than the
$NaO, 2VO_3$ potash salt in water. Insoluble in alcohol.

VANADIATE OF STRONTIA.
I.) *mono.* Somewhat more soluble than the
SrO, VO_3 baryta salt in water.
II.) *bi.* Permanent. More soluble than the
$SrO, 2VO_3 + 9Aq$ baryta salt in water.
III.) *basic.*

VANADIATE OF THORIA.
I.) *mono.* Insoluble in water.
ThO, VO_3
II.) *bi.* Soluble in water.

VANADIATE *of protoxide* **OF TIN.** Soluble in
SnO, VO_3 water. . (Berzelius, *Lehrb.*)

VANADIATE *of binoxide* **OF TIN.** Soluble in
$SnO_2, 2VO_3$ water. (*Ibid.*)

VANADIATE *of sesquioxide* **OF URANIUM.**
I.) *normal.* Insoluble in water. (Berzelius.)
Ur_2O_3, VO_3
II.) *acid.* Insoluble in water.

VANADIATE OF VANADIUM.
I.) "*Green Oxide of V.*" Completely soluble
$VO_2, 2VO_3$ in pure water. Sparingly soluble in water which contains a salt like chloride of ammonium in solution. Sparingly soluble in alcohol of 0.86 sp. gr., but insoluble in absolute alcohol.
II.) "*Yellowish Green Oxide of V.*" More
$VO_2, 4VO_3$ sparingly soluble than No. I. in water, and is more completely precipitated on the addition of salammoniac.
III.) "*Orange Yellow Oxide of V.*" Much more easily soluble than vanadic acid. Soluble in 22.5 pts. of water. (Berzelius, *Lehrb.*, 2. 342.)

VANADIATE OF YTTRIA.
I.) *mono.* Ppt. Somewhat soluble in water.
YO, VO_3
II.) *bi.* Soluble in water.

VANADIATE OF ZINC.
I.) *mono.* Insoluble in water, even when this
ZnO, VO_3 is boiling. (Berzelius.)
II.) *bi.* Easily soluble in water. (Berzelius.)

VANADIATE OF ZIRCONIA.
I.) *normal.* Soluble in water.
$Zr_2O_3, 3VO_3$
II.) *acid.* Soluble in water. (Berzelius, *Lehrb.*)

VANADIOUS ACID. *Vid. bin*Oxide of Vana-
VO_2 dium. Of the metallic vanadites only those of the alkalies are soluble in water.

VANADITE OF AMMONIA. Easily soluble in
NH_4O, VO_2 pure water. Insoluble, or only very sparingly soluble, in ammonia-water.

VANADITE OF MANGANESE. Decomposed by water which contains air.

VANADITE *of protoxide* **OF MERCURY.** Insoluble in water.

VANADITE OF POTASH. Permanent. Very
KO, VO_2 soluble in water. Insoluble in alcohol, or in a cold aqueous solution of caustic potash.

VANADIUM. Permanent. Unacted upon by
Va water, or by sulphuric, chlorhydric, or fluorhydric acid, or by alkaline solutions. Soluble in nitric acid, and aqua-regia.

VANILLIN (from the fruit of *Vanilla aromatica.*)
$C_{20}H_6O_4$ Almost insoluble in cold, readily soluble in boiling water. (Gobley; A. Vée.) Readily soluble in alcohol, ether, and in the fatty and volatile oils. (Gobley.) Soluble in dilute acids, without decomposition. Also soluble, with yellow color, in concentrated sulphuric acid. Easily soluble, without decomposition, in an aqueous solution of caustic potash. (Gobley.)

VARIOLARIN (from *Variolaria dealbata*). Insol-
(*Same as Lecanoric Acid?*) uble in water. Easily soluble in alcohol, and ether. (Robiquet.)

VASCULOSE. Insoluble in water, alcohol, ether, concentrated acids, or an aqueous solution of cupramin. Soluble in boiling concentrated potash-lye. (Fremy.)

VERATRIC ACID. Sparingly soluble in cold,
$C_{18}H_{10}O_8 = C_{18}H_9O_7, HO$ more soluble in boiling water. Very abundantly soluble in boiling alcohol. Insoluble in ether.

VERATRATE OF AMMONIA. Soluble in water, and alcohol.

VERATRATE OF ETHYL. Scarcely at all solu-
$C_{18}H_9(C_4H_5)O_8$ ble in water. Easily soluble in alcohol. (Will.)

VERATRATE OF LEAD. Insoluble in water.

VERATRATE OF LIME. Soluble in alcohol.

VERATRATE OF POTASH. Permanent. Soluble in water, and alcohol.

VERATRATE OF SILVER. Somewhat soluble
$C_{18}H_9AgO_8$ in water, and alcohol. (Merck.) Decomposed by boiling water. Soluble in ammonia-water. (Schrœtter.)

VERATRATE OF SODA. Permanent. Soluble in water, and alcohol.

VERATRINE. Efflorescent. Insoluble in boil-
$C_{64}H_{52}N_2O_{16} = N_2 \left\{ C_{64}H_{52}O_{16}^{VI} \right.$ ing water. Readily soluble in alcohol; and especially in ether. Easily soluble, with combination, in weak acids, even carbonic acid water. (Langlois.) Soluble in concentrated chlorhydric acid. Insoluble in alkaline solutions.

Soluble in 3 pts. of cold alcohol.
" 2 " boiling "
" 50 " ether.
(Wittstein's *Handw.*)

100 pts. of chloroform dissolve 11.6 pts. of it. (Schlimpert, *Kopp & Will's J. B. für* 1859, p. 405.) 100 pts. of chloroform dissolve 58.49 pts. of it. (Michael Pettenkofer, *Kopp & Will's J. B. für* 1858, p. 363.) 100 pts. of olive-oil dissolve 1.78 pts. of it. (Pettenkofer, *Ibid.*)

The salts of veratrin are in general freely soluble in glycerin. (Parrish's *Pharm.*, p. 236.)

VERATRAL. Unacted upon by alkalies.
$C_{16}H_{10}O_4$

*Bi*VINAMYLAMIN. *Vid. bi*EthylAmylamin.

VINAMYLANILIN. *Vid.* EthylAmylAnilin.

VINAMYLICETHER. *Vid.* Oxide of Amyl & of Ethyl.

Vinemyl Anilin. *Vid.* EthylAmyl Anilin.

Vinic Butyrate. *Vid.* Butyrate of Ethyl.

Vinic Acid. *Vid.* ParaTartaric Acid.

Vinic Ether. *Vid.* Oxide of Ethyl.

Vinic Oxalate. *Vid.* Oxalate of Ethyl.

Vinic Sulphate. *Vid.* Sulphate of Ethyl.

Vinic Sulphite. *Vid.* Sulphite of Ethyl.

VinoBenzylic Ether. *Vid.* Oxide of Ethyl & of Toluenyl.

VinoButylic Ether. *Vid.* Oxide of Butyl & of Ethyl.

VinoCacodyl. *Vid.* Arsen*bi*Ethyl.

VinoComenic Acid. *Vid.* EthylComenic Acid.

VinoMellitic Acid. *Vid.* EthylMellitic Acid.

VinoMethylid. *Vid.* Oxide of Ethyl & of Methyl.

VinoMethylic Oxalate. *Vid.* Oxalate of Ethyl & of Methyl.
$C_{10}H_8O_8$

VinoMethylicOxySulphoCarbonate. *Vid.* OxySulphoCarbonate of Ethyl and of Methyl.
$C_8H_8O_2S_4$

Vinyl(of Kolbe). *Vid.* Acetoyl.
(“*Acetyl*”(*of Berzelius*).)
C_4H_3

*Tetra***Vinylium.** Not isolated.
(*Tetraacetylium. Tetraacetosylium. Tetrellallylammonium.*)

Violin(from *Viola odorata*). More readily soluble in water, but less soluble in spirit than emetin. Insoluble in ether or oils. (Boullay.)

Viridic Acid. Readily soluble in water, and in dilute acetic acid. Soluble in concentrated sulphuric acid.
$C_{28}H_{14}O_{16} = C_{28}H_{12}O_{14}, 2HO$

Viridate of Baryta. Ppt.
$C_{28}H_{12}Ba_2O_{16} + 2Aq$

Viridate *of dinoxide* **of Copper.** Ppt., in alcohol. Soluble in boiling water.

Viridate of Lead. Ppt.
$C_{28}H_{12}Pb_2O_{16} + 2Aq$

Viscin(from *Atractylis gummifera*). Insoluble in water. Sparingly soluble in alcohol. Easily soluble in hot ether, and in oil of turpentine. Insoluble in fatty oils. (Macaire.)

Vitellin. Resembles albumen very closely, occurring, like this, both in a soluble and an insoluble modification. The soluble modification is not precipitated from its aqueous solution by organic acids, or by ordinary phosphoric acid, but is thrown down by sulphuric and chlorhydric acids; its solution begins to become opalescent at 60°, and at 73° @ 76° deposits flakes. It is only distinguished from soluble albumen by the circumstances, that (without the addition of acetic acid or salts) when heated it forms flakes and clots, that it is not precipitated by the salts of lead or copper, and that it is thrown down by ether. Coagulated vitellin has the same properties as coagulated albumen. (Lehmann.) (Compare Dumas & Cahours, *Ann. Ch. et Phys.*, (3.) **6.** 422.)
(*From the yolk of egg.*)

Vitriolized Tartar. *Vid.* Sulphate of Potash.

Vulpic Acid. *Vid.* Chrysophanic Acid.

W.

Water. Miscible with alcohol. Soluble in 36 pts. of ether.
H O

Soluble in 30 @ 33 volumes of acetate of ethyl. (Becker.) Soluble in 5 volumes of iodhydrin. (Berthelot & De Luca, *Ann. Ch. et Phys.*, (3.) **43.** 280.) Slightly soluble in most of the fatty oils.

Only minute traces of water are dissolved by anhydrous liquid sulphurous acid at temperatures below —10°, at the ordinary pressure. Even at the temperature of +10°, and under a pressure of several atmospheres, not more than 0.005 pts. of water are dissolved. (Pierre, *Ann. Ch. et Phys.*, (3.) **23.** 431.)

Waterglass. See Silicate of Soda; and Silicate of Potash.

Waxes. Are insoluble in water. Rather difficultly soluble in alcohol, and in alkaline solutions. Easily soluble in ether, and oils. They are soluble in benzin (Mansfield, *J. Ch. Soc.*, **1.** 261), in chloroform (Parrish's *Pharm.*, p. 318), and in oils, both fixed and essential.

Wax of Andiquies(a New Granadian insect). Is composed of palm wax and sugar-cane wax. (Lewy, *Ann. Ch. et Phys.*, (3.) **13.** 454.)

Angelica Wax(from *Archangelica officinalis*). Insoluble in water. More readily soluble in alcohol, and ether than beeswax. Sparingly soluble in potash-lye. (Buchner.)

Beeswax. Contains Cerotic Acid and Myricin, *q. v.*, the relative proportions of these ingredients being subject to variations. Beeswax is completely insoluble in water; partially soluble in alcohol; cold alcohol dissolving but little, while boiling alcohol dissolves the greater part of it, to deposit it again on cooling. The portion difficultly soluble in boiling alcohol requires 200 pts. of this, and 99 pts. of cold ether, for its solution. The portion easily soluble in hot alcohol is easily soluble in ether. Soluble in warm acetone, a portion separating out as the solution cools; water produced a precipitate in the cold solution. (Chenevix, *Ann. de Chim.*, 1809, **69.** 50.) Soluble in hot oil of bay (Brandes), in oil of mandarin. (Luca.) Soluble in all proportions in the fatty and essential oils.

Bicüyba Wax(from *Myristica bicuhyba*). Soluble in boiling alcohol. (Lewy, *loc. cit.*)

Carnanba Wax(from Brazil). Soluble in boiling, less soluble in cold alcohol, and ether. (Brandes; Lewy, *loc. cit.*, p. 449.) Miscible in all proportions with fatty oils. (Brandes.)

Chinese Wax. *Vid.* Cerotate of Ceryl.

Wax of Chlorophyll.

Wax of Cork. Insoluble in water. Soluble in alcohol, ether, and easily in alkaline solutions.
(*Cerin.*)
$C_{50}H_{40}O_6$

Japan Wax(from *Rhus succedanea*). Almost insoluble in cold alcohol, easily and completely soluble in hot absolute alcohol, and still more easily in warm ether. Tolerably easily saponified by potash-lye. (Meyer & Sthamer.)
(*Probably identical with Palmitin.*)

Wax of Myrica(from several species of *myrica*).

Wax of Ocuba(from several species of *myristica.*) Soluble in boiling alcohol. (Lewy, *loc. cit.*)

Ozokerit Wax. Soluble in ether.
$C_{40} H_{40}$''

Wax of the Palm-Tree (from *Ceroxylon andicola*). Insoluble in water. Sparingly soluble in boiling, and still less soluble in cold alcohol. (Lewy, *Ann. Ch. et Phys.*, (3.) **13.** 448.)

Wax of the Sugar-Cane. *Vid.* Cerosin.

"White Precipitate." *Vid.* Chloride of Mercurammonium.

Wood Ether. *Vid.* Oxide of Methyl.

Wood Naphtha. }
Wood Spirit. } *Vid.* Hydrate of Methyl.

X.

Xanthamid. *Vid.* Hydrate of SulphoCarbonylEthylammonium.

XanthAmylamid. (*SulphoCarbamate of Amyl. AmylXanthogenamid.*) $C_{12} H_{13} N S_2 O_2$ Insoluble in water. Very soluble in alcohol, and ether. Soluble in cold concentrated sulphuric acid, in which solution the addition of water produces a precipitate. Unacted upon by boiling chlorhydric acid. (M. W. Johnson, *J. Ch. Soc.*, **5.** 145.)

XanthAmylamic Acid. *Vid.* OxySulphoCarbonate of Amyl.

Xanthein. (*Properly AnthoXanthein.*) Soluble in water, alcohol, and ether. (Fremy & Cloez.)

Xanthelene. *Vid.* OxySulphoCarbonate of Ethyl (No. II.).

Xanthic Acid. }
Xanthic Ether. } *Vid.* OxySulphoCarbonate of Ethyl.

Xanthic Oxide. (*Urous Acid. Xanthin (improperly).*) $C_{10} H_4 N_4 O_4$ Insoluble in cold, soluble to a slight extent in boiling water. (Marcet.) Completely, though difficultly, soluble in boiling water. Soluble in 723 pts. of boiling, and in 1950 pts. of cold water. (Cited by Weltzien.) Insoluble in alcohol or ether. (Marcet.) Soluble in concentrated sulphuric acid, from which solution it is not precipitated on the addition of water. Also soluble in nitric acid. Insoluble, or nearly insoluble, in chlorhydric and oxalic acids. (Liebig & Wœhler.) Very sparingly soluble in dilute acids, or in acetic acid. (Marcet.) Soluble in aqueous solutions of the caustic alkalies. More soluble than uric acid in ammonia-water. Soluble in an aqueous solution of carbonate of potash, but not in solutions of the alkaline bicarbonates. (Marcet.)

Xanthil. $C_4 H_5 O_3$? Insoluble in water. Soluble in alcohol, and ether. Unacted upon by alkaline solutions. (Courbe.)

"Xanthin." *Vid.* Xanthic Oxide.

Xanthin (of Kuhlmann). (*Yellow coloring matter of Madder.*) Easily soluble in water, and alcohol. Almost insoluble in ether. Soluble in dilute acids. (Kuhlmann.)

Xanthin (of Fremy & Cloez). (*Properly AnthoXanthin. Yellow coloring matter of Flowers.*) Insoluble in water. Soluble in boiling, insoluble in cold alcohol, and ether. (Fremy & Cloez.)

Xanthobetic Acid. Hygroscopic. Easily soluble in water, and absolute alcohol. The alkaline and alkaline earthy salts of xanthobetic acid are soluble in water. (L. Meier.)

XanthoCobalt. Its salts are rather more soluble, both in hot and cold water, than those of roseo-, purpureo-, or luteo-cobalt. Solutions of its salts are decomposed by boiling, though sometimes with difficulty. When heated with mineral acids they are decomposed; but when solutions of them are slightly acidulated with acetic acid, they may be evaporated without much decomposition. (Gibbs & Genth, *Smithsonian Contrib.*, vol. **9.**)

Xanthogenamid. *Vid.* Hydrate of SulphoCarbonylEthylammonium.

Xanthogenic Acid. *Vid.* OxySulphoCarbonate of Ethyl.

Xanthoil. Scarcely soluble in water. Readily soluble in alcohol, even when this is very dilute. (Zeise.)

Xanthopenic Acid. Ppt.

Xanthopenate of Potash. Soluble in water, at least when this is alkaline. (Wœhler.)

Xanthophyll. (*Yellow coloring matter of autumn leaves.*) Insoluble in water. Difficultly soluble in alcohol; more easily soluble in ether. Also sparingly soluble in an aqueous solution of caustic potash. Decomposed by concentrated sulphuric acid. (Berzelius, *Ann. der Pharm.*, 1837, **21.** 260.)

Xanthopicrit (from the bark of *Xanthoxylum Clava-Herculis*). Permanent. Somewhat difficultly soluble in water. Easily soluble in alcohol. Insoluble in ether. (Chevallier & Pelletan.)

XanthoProteic Acid. (*XanthoProtein.*) $C_{34} N_{26} N_4 O_{14}$ (?) Insoluble in water, alcohol, or ether. Soluble in concentrated acids, and in alkaline solutions.

XanthoProteate of Ammonia.

XanthoProteate of Baryta. Readily soluble in water. Insoluble in alcohol or ether.

XanthoProteate of Copper (Cu O). Ppt.

XanthoProteate *of protoxide* of Iron. Ppt.

XanthoProteate of Lead. Ppt.

XanthoProteate of Lime.

I.) Soluble in water.

II.) *basic.* Insoluble in water.

XanthoProteate of Potash.

XanthoProteate of Silver. Ppt.

XanthoProteate of Soda.

XanthoRhamnin. $C_{28} H_{12} O_4$ (?) Readily soluble in water, and alcohol. Entirely insoluble in ether. (Kane, *Proc. R. Irish Acad.*, **2.** 224.)

Xanthoxylene.
$C_{10} H_8$

Xanthoxylin. $C_{10} H_6 O_4$ Insoluble in water, even when this is boiling. Easily soluble in alcohol, and ether. (Stenhouse, *Ann. Ch. u. Pharm.*, **104.** 238.)

Xanthurin. $C_8 H_8 O_4 S =$ "$C_4 H_5 O, C_4 H_3 O_3 S$" Decomposed by an alcholic solution of caustic potash. (Courbe.)

Xanthurin Gas. (*Xanthin Gas.*) "$C_4 H_2 S_4 O_4$" 1 volume of alcohol absorbs 12 vols. of it; 1 vol. of ether, 20 vols.; 1 vol. of oil of turpentine, 10 vols. Slowly absorbed by potash-lye. (Courbe.)

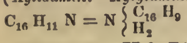
Xylene. Insoluble in water. Readily soluble in alcohol, and ether. Slowly soluble in concentrated sulphuric acid. (Vœlckel.)
(*Xylol. Hydride of Xylyl.*)
$C_{16} H_{10}$

Xylenyl Alcohol. *Vid.* Phloretol.

XylenylSulphurous Acid. Very deliquescent. Exceedingly soluble in water, and in concentrated sulphuric acid. Soluble in xylene. (Church, *Phil. Mag.*, **9.** 455.)
(*SulphOxylolic Acid. XylolSulphuric Acid.*)
$C_{16} H_{10} S_2 O_6$

XylenylSulphite of Baryta. Soluble in water, especially if this is hot. (Church, *loc. cit.*)
$C_{16} H_9 Ba S_2 O_6$

Xylidin.
(*Xylidamin. Xylylamin.*)



$C_{16} H_{11} N = N \left\{ \begin{matrix} C_{16} H_9 \\ H_2 \end{matrix} \right.$

Xylite. *Vid.* Lignone.

Xylite Oil. Nearly insoluble in water. Readily soluble in wood-spirit, ether, alcohol, and lignone. (Weidmann & Schweitzer.)
$C_{12} H_9 O$

Xylite Resin.

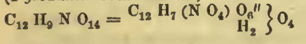
a = Brown. Insoluble in water or potash-lye. Readily soluble in alcohol, ether, and lignone. (Weidmann & Schweitzer.)
$C_{24} H_{18} O_3$

b = Yellow. Nearly insoluble in weak spirit. Soluble in strong alcohol, and in ether. (W. & S.)

Xylitic Naphtha. Very sparingly soluble in water. Readily soluble in alcohol, ether, and lignone. (Weidmann & Schweitzer.)
$C_{12} H_{12} O_3$

Xylyl. Not isolated.
$C_{16} H_9$

Xyloidin. Insoluble in water, alcohol, ether, or a mixture of alcohol and ether. Easily soluble in acetic acid, even when this is cold. Soluble, with decomposition, in chlorhydric acid. Easily soluble in nitric acid, both concentrated and dilute. Insoluble in a dilute solution of caustic potash. (Béchamp, *Ann. Ch. et Phys.*, (3.) **46.** 349.) Becomes soft and adhesive when boiled with water and dilute sulphuric acid, without dissolving to any appreciable extent. Very sparingly soluble, or insoluble, in alcohol. Dissolves to a gelatinous solution in a mixture of alcohol and ether. Soluble in warm concentrated chlorhydric acid, and is precipitated therefrom on the addition of water. Also soluble in concentrated sulphuric acid, but is not reprecipitated on the addition of water. Soluble, with decomposition, in cold dilute nitric acid. Soluble to a thick slime in acetic acid; this solution coagulates on the addition of water. (Wittstein's *Handw.*)
(*Pyroxam. NitrAmidin.*)



$C_{12} H_9 N O_{14} = \left. \begin{matrix} C_{12} H_7 (N O_4) O_6'' \\ H_2 \end{matrix} \right\} O_4$

Xylol. *Vid.* Xylene.

Xyloretin. Insoluble in water. Readily soluble in strong alcohol, and ether. (Forchammer.)
$C_{40} H_{32} O_4$

Xylostein (from the berries of *Lonicera xylosteum*). Sparingly soluble in cold, abundantly soluble in boiling water. Very easily soluble in alcohol, and in ether. Decomposed by acids.

Xylylamin. *Vid.* Xylidin.

Y.

Yellow Prussiate of Potash. *Vid.* Ferrocyanide of Potassium.

Yttrium. Unacted upon by air or water at the ordinary temperature. Soluble in dilute acids, and somewhat more difficultly in potash-lye. Insoluble in ammonia-water. (Wœhler.)
Y

Z.

Zein (gluten of *Zea mais*). Insoluble in water. Soluble in alcohol. Partially soluble in ether, oil of turpentine, and alkaline solutions. Unacted upon by concentrated chlorhydric acid. Soluble in concentrated sulphuric acid. Decomposed by concentrated nitric acid. (Gorham; Bizio.)

Zinc. Unacted upon by cold water free from air. Slowly oxydized by boiling water, the latter being decomposed. (H. Deville; Cooke.) Easily soluble in dilute chlorhydric, sulphuric, and nitric acids; and in almost all the acids which are soluble in water, when these are not too dilute. Slowly soluble in warm aqueous solutions of caustic potash, and ammonia, and even in a boiling aqueous solution of chloride of ammonium.
Zn

Soluble in a neutral aqueous solution of protochloride of iron, especially if this is heated to boiling, some metallic iron being meanwhile deposited. (Capitaine, *C. R.*, 1839, **9.** 737.) Soluble in an aqueous solution of normal sulphate of nickel, some oxide of nickel being precipitated meanwhile. (Tupputi, *Ann. de Chim.*, 1811, **78.** 149.) A strong hot aqueous solution of chloride of zinc is capable of oxydizing and dissolving an excess of zinc, and the solution may remain perfect on cooling, but on diluting it with water oxychloride of zinc is immediately precipitated. (Ordway, *Am. J. Sci.*, (2.) **23.** 222.)

Zinc is not attacked by pure nitric acid of 1.512 @ 1.419 sp. gr. at a temperature of —18° or less, the metal covering itself with a yellowish white coat, which prevents further action; at a higher temperature this coating dissolves, and the metal is at once attacked by the acid. Nitric acid of 1.419 @ 1.401 sp. gr., or even somewhat more dilute, does not attack zinc at the temperature of a freezing mixture, though at 0°, and above, the action is violent. Pure nitric acid, more dilute than this, attacks zinc, even at the temperature of a mixture of ice and salt. (Millon, *Ann. Ch. et Phys.*, (3.) **6.** 99.) Soluble in carbonic acid water. (Berzelius, *Lehrb.*, **3.** 689.) When pure zinc is melted at the lowest possible temperature, and the molten mass immediately poured into cold water, the metal obtained is but slowly acted upon by dilute sulphuric acid. If another portion of zinc thus melted is poured on to a warm plate, it is somewhat more soluble in sulphuric acid than the preceding, but still dissolves with difficulty. But if the same melted zinc be heated nearly to redness, and then poured into cold water, it is readily soluble in dilute sulphuric acid, and if poured on to a warm plate, it is still more soluble in sulphuric acid. (Bolley, *Ann. Ch. u. Pharm.*, **95.** 303.) Zinc which contains $\frac{1}{10}$ pt. of iron, lead, copper, or tin, is much more soluble in dilute acids than pure zinc. (De la Rive.) The power of acids, &c., to dissolve zinc is greatly influenced by the presence of small quantities of various metallic solutions. In the following experiments six nearly equal portions of commercial zinc, in thin sheets, were each treated, during ten minutes, with 0.15 litre of a mixture of 1 pt. of monohydrated sulphuric acid, and 12 pts. of water; in flask No. I., which contained nothing but the dilute sulphuric acid, the 10.119 grms. of zinc taken lost 0.028 grm.; in No. II., which, beside the acid, received 4 drops of a solution of 1 pt. of bichloride of platinum in 10 pts. of water, 10.466 grms. of zinc lost 4.298 grms.; in No. III., which, beside the acid, contained 10 drops of a saturated solution of tartar emetic, 10.600 grms. of zinc lost 0.8 grm.; in No. IV., which, beside the acid, contained 10 drops of a saturated solution of sulphate of copper, 9.808 grms. of zinc lost 1.234 grms.; in No. V., which, beside the acid, contained 15 drops of a saturated solution of arsenious acid, 10.857 grms. of zinc lost 3.706 grms.; in No. VI., which, beside the acid, contained 15 drops of a saturated solution of sulphate of silver, 10.349 grms. of zinc lost 0.071 grm. It was impossible to employ in each experiment exactly the same quantity of zinc, but the results may be conveniently compared by reducing the numbers above given, for the original weight of zinc taken, and the loss of zinc, to a common expression, taking as unity the action of the pure dilute acid upon the metal, — as in the following table:

Action of pure dilute SO_3	. .	1
" do. with	$PtCl_2$	149
" " "	AsO_3	123
" " "	CuO, SO_3	45
" " "	$C_8H_4Sb_3KO_{14}$	29
" " "	AgO, SO_3	2.4

On adding the foregoing saline solutions, it is observed, that the action of bichloride of platinum is immediate, and subsequently tends to decrease; the influence of arsenious acid, on the other hand, is rather slowly established, but it increases rapidly, and soon equals that of the platinum salt; the sulphate of copper, tartar emetic, and sulphate of silver, also produce an increasing acceleration. In the case of sulphate of silver this increase was measured; in two experiments, which lasted an hour, instead of ten minutes, the following results were obtained: in No. I., 10.091 grms. of zinc, treated with the unadulterated dilute sulphuric acid, lost 1.187 grms.; in No. II., treated with sulphuric acid, + 15 drops of a saturated solution of sulphate of silver, 10.278 grms. of zinc lost 5.527 grms. Thus the acceleration produced by sulphate of silver is expressed by the number 2.4 when the reaction lasts ten minutes, and by 4.6 when it lasts an hour. Solutions of salts of cobalt, nickel, tin, cadmium, chrome, lead, antimony, and bismuth, all accelerate the evolution of hydrogen when added to a mixture of zinc and dilute sulphuric acid, but the amount of their influence was not determined, since the examples above given appear to offer the most striking cases, both of slow and of rapid acceleration. When a few drops of protochloride of mercury ($HgCl$) are added to dilute sulphuric acid, which is acting upon zinc, the latter becomes covered with a coat of amalgam, as is well known, and is thus protected from the further action of the acid. In an experiment, made for the purpose of determining the amount of this preservation of zinc by mercury, 20.978 grms. of sheet zinc were left during seventy hours in contact with a quantity of dilute sulphuric acid (1 pt. of $HO, SO_3 + 10$ pts. of water) sufficient to dissolve the whole of it in about an hour and a half, the loss of zinc during these seventy hours having been only 0.343 grm. It appears, therefore, that a small quantity of mercury acts in a manner diametrically opposed to that of a small quantity of platinum or arsenic. These differences become still more frequent and striking when different metals are treated with equal small portions of a given metallic solution; iron, for example, may be preserved by the addition of a solution which is capable of increasing the solution of zinc a hundred-fold.

In order to determine the influence which might be exerted upon the action of the metallic solution by varying the proportion of the latter, the following experiments were made: in No. I., in which to the dilute sulphuric acid (1 pt. $HO, SO_3 + 12$ pts. HO) 1 drop of bichloride of platinum was added, 10.379 grms. of zinc lost, in five minutes, 1.848 grm.; and in No. II., where 10 drops of $PtCl_2$ were added to a similar acid, 10.257 grms. of zinc lost, in five minutes, 3.871 grms., the quantity of bichloride of platinum in becoming ten times greater, having produced an action about twice as energetic as before.

With regard to the persistence of the influence exerted by these small quantities of metallic solutions, an idea may be gained from the following experiments: 1st.) Three quantities of zinc, sensibly equal in weight, were immersed separately in dilute sulphuric acid (1 pt. $HO, SO_3 + 12$ pts. of HO), and then withdrawn, the first piece after five minutes, the second after 10 minutes, and the third after 15 minutes. 2d.) Three portions of zinc, sensibly equal in weight to the preceding, were immersed in similar sulphuric acid, to which had been added 4 drops of bichloride of platinum, and subsequently withdrawn after the lapse of the same intervals of time as in the preceding experiment.

First Series. SO_3 alone.

					grms.
Zinc taken	15.104 grms.;	loss in	5	minutes	0.025
"	15.041 "	"	10	"	0.058
"	15.215 "	"	15	"	0.120

Second Series. $SO_3 + 4$ drops of $PtCl_2$.

Zinc taken	15.352 grms.;	loss in	5	minutes	3.653
"	15.326 "	"	10	"	6.325
"	15.237 "	"	15	"	7.206

The action of dilute sulphuric acid on zinc is a rapidly increasing action; but this is no longer the case when the acid contains traces of bichloride of platinum. Thus, when the initial action is no longer considered, we are far from finding very considerable differences after the addition of bichloride of platinum. If, for example, the times necessary for complete solution are considered, it will be found that the bichloride of platinum only renders the solution five or six times more rapid. The state of concentration of the acid is also an important point to be considered. An acid diluted with 10 instead of 12 pts. of water exhibits less characteristic effects, and, with increasing concentration of the acid, these effects are gradually effaced.

The action of other mineral acids and of organic acids upon zinc is influenced, like that of dilute sulphuric acid, by the presence of small portions of metals; but the amount of this influence varies with each acid. These differences may be appreciated by the following numbers, determined with chlorhydric acid. The chlorhydric acid must be very dilute, in order that the addition of small quantities of metallic salts shall strongly influence its action; no less than 40 vols.

of water being necessary for 1 vol. of strong chlorhydric acid. In the following experiments, conducted like those with sulphuric acid, the contact of the zinc and acid lasted an hour: in No. I. dilute chlorhydric acid, without any addition, acting upon 5.64 grms. of zinc, the latter lost 0.059 grm.; in No. II., using dilute chlorhydric acid, + 4 drops of bichloride of platinum, 5.691 grms. of zinc lost 2.586 grms.; in No. III., using dilute chlorhydric acid, + 20 drops of a saturated solution of arsenious acid, 5.664 grms. of zinc lost 2.258 grms.; in No. IV., using dilute chlorhydric acid, + 15 drops of tartar emetic, 5.656 grms. of zinc lost 2.054 grms. Reducing these, as before, to a common standard, we have,

Action of pure dilute acid . .	1
" " " + $Pt\,Cl_2$	43
" " " + $As\,O_3$	38
" " " + $C_8\,H_4\,Sb_3\,K\,O_{14}$	35

Whence it appears that bichloride of platinum is far from producing so strong an acceleration in this case as with sulphuric acid; and that tartar emetic, which, with sulphuric acid, acts five times less strongly than bichloride of platinum, exerts, in presence of chlorhydric acid, an influence almost equal to that of the latter salt.

Neither dilute nor concentrated solutions of oxalic acid convert zinc [completely] into oxalate, even at the temperature of ebullition. But if the least trace of bichloride of platinum be added, the metal is completely converted to oxalate, even in the cold, although oxalate of zinc is insoluble. The bichloride of platinum is the only one of the substances in question which acts in this case in a well-defined manner; sulphate of copper, arsenious acid, etc., appearing to exert no influence.

Glacial acetic acid, diluted with one volume of water, attacks zinc feebly; but a single drop of bichloride of platinum communicates a most remarkable intensity to the reaction. On comparing the amounts of zinc dissolved in the two cases, it was found that 200 times more had passed into solution by virtue of the bichloride of platinum. In the case of this weak acid, protochloride of mercury (Hg Cl) exerts no preserving influence; arsenious acid develops its accelerating action only after a very long time; sulphate of copper and tartar emetic accelerate the action, but much less than the platinum salt. Dilute butyric acid behaves precisely like acetic acid. Citric acid exhibits these accelerations very clearly. When dissolved in 5 or 6 pts. of water its action upon zinc is very feeble, but the addition of bichloride of platinum, sulphate of copper, or arsenious acid occasions a very abundant evolution of hydrogen; sulphate of silver exerts no appreciable influence; protochloride of mercury (Hg Cl) preserves the metal very well. Tartaric acid dissolved in 7 or 8 pts. of water presents phenomena analogous to those exhibited by citric acid, excepting only sulphate of silver, which considerably accelerates the conversion of zinc into tartrate. Racemic acid behaves also like the two preceding acids; as with tartaric acid, sulphate of silver accelerates the formation of racemate of zinc, but arsenious acid only acts very slowly.

An energetic action upon zinc is also produced by various saline solutions after these have been mixed with small quantities of the metallic solutions above mentioned. In this category may be enumerated aqueous solutions of the chlorides of potassium and sodium, the sulphates of soda, potash, and magnesia, and the hydrates of soda, potash, and ammonia; it being only necessary to add some drops of bichloride of platinum in order that these solutions shall cause a very sensible evolution of hydrogen from granulated zinc, even in the cold, while at the temperature of boiling hydrogen is produced in abundance.

Sea-water, river-water, and even distilled water, are decomposed by zinc when in presence of small quantities of some of these metallic solutions. The distilled water furnishing less hydrogen than the waters which contain saline matter. The disengagement of hydrogen commences immediately, but continues for a long time; thus, a flask of the capacity of 8 ounces, containing some granulated zinc, was filled with distilled water, to which had been added six drops of bichloride of platinum; hydrogen was immediately evolved, 300 c.c. being formed in the course of 24 hours, the development continued at about this rate during the second and third day, while at the end of eight days only 200 c.c., or thereabouts, of gas were formed in the course of 24 hours; at the end of twenty days, however, the production of hydrogen still continued. It must be remarked, in this connection, that bichloride of platinum and sulphate of copper are the only metallic salts capable of causing zinc to decompose, and be dissolved by distilled water; neither arsenious acid, tartar emetic, nor sulphate of silver producing a single bubble of hydrogen. Bichloride of platinum, moreover, acts much more energetically than sulphate of copper; and among the saline solutions, the solution of sulphate of soda affords the most abundant disengagement of hydrogen. In a case where a saturated solution of chloride of sodium, together with some bichloride of platinum, furnished 127 c.c. of hydrogen, a saturated solution of sulphate of soda, furnished, under analogous conditions, 224 c.c.

Upon the reactions above described light exerts a decided influence. This influence may be most readily proved by means of the slow reactions, as those with saline solutions. As a general rule, the disengagement of hydrogen is slower when light is avoided. But in certain cases the diminution of action exhibits very peculiar characteristics; thus, if two flasks of equal size, one of which is protected from the light by envelopes of black paper and tin foil, while the other receives the direct light of the sky, are taken, and equal portions of sheet zinc and a saturated solution of chloride of sodium, plus bichloride of platinum, introduced into each, the two flasks being placed side by side in a basin of water, in order to maintain equilibrium of temperature; a more rapid evolution of hydrogen will be observed at first in the covered flask, but suddenly the gas ceases to be evolved from this flask, and, after the lapse of several hours, it is useless to remove the envelopes, for hydrogen is no longer formed. In the other, uncovered flask, however, the disengagement of gas, though much slower in the beginning, goes on without interruption, and may last during several months.

When, in the acid or saline solutions above mentioned, or even in the pure water, the zinc comes in contact with the small portion of metallic solution which has been added, it is easy to see that the metal of the latter is precipitated upon the zinc. As by this means there is formed a small quantity of chloride, or other salt, of zinc, corresponding to the bichloride of platinum, or other salt employed, the question arises, whether the salt thus formed participates in the reactions under discussion. But it is clear that this influence, if appreciable, must be very feeble, for if after the precipitation of the platinum, or other metal, the sheet of zinc upon which it has fallen is thoroughly washed, and then placed in a fresh acid or saline solution, in which the salt resulting from the precipitation can no longer form, the disengagement of hydrogen will go on just as if the solution had not been changed. (Millon, *C. R.*, 1845, **21**. pp. 37 – 45.) In connection with Millon's observations, compare the remarks of Barreswil (*C. R.*, **21**. 292), who urges that these reactions may all be explained by referring to galvanic action, induced by the precipitated metal. According to B., the action of chlorhydric acid upon zinc may be accelerated as well by placing a platinum wire in contact with the zinc, as by adding a solution of bichloride of platinum. Again, the addition of a metallic salt accelerates the solution of zinc by acids, etc., only in those cases where the metal, as it is precipitated upon the zinc, forms a loose spongy coating; for if a compact adherent layer of any metal incapable of decomposing water is formed upon the zinc, the latter is, as it were, varnished, and being no longer in contact with the acid, cannot be acted upon thereby.

Most of the salts of zinc are soluble in water, and all which are insoluble in water dissolve in chlorhydric acid, and in a hot aqueous solution of chloride of ammonium.

ZINCACETAMID. Decomposed by water.
$N\left\{\begin{matrix}C_4\,H_3\,O_2\\H\\Zn\end{matrix}\right.$

ZINCAMID. Instantly decomposed by water, and alcohol. Insoluble in ether. (Frankland.)
$N\left\{\begin{matrix}H_2\\Zn\end{matrix}\right.$

ZINCAMYL. Decomposed by water. (Frankland.)
(*Amylide of Zinc.*)
$C_{10}\,H_{11}\,Zn$

ZINCANILIN. Decomposed by water.
(*ZincPhenylamin.*)
$N\left\{\begin{matrix}C_{12}\,H_5\\Zn\\H\end{matrix}\right.$

ZINCATE OF POTASH. Readily soluble in water, the solution undergoing decomposition when boiled. (Laux.) Decomposed by pure water. Soluble in alkaline liquors. It may sometimes be crystallized by adding alcohol to the weak alkaline solution. (Fremy, *Ann. Ch. et Phys.*, (3.) **12**. 382.)

ZINCATE OF SODA. Soluble in water. (Dumas, *Tr.*)

ZINCETHYL. Decomposed by water, and dilute acids. Soluble in anhydrous ether. (Frankland, *J. Ch. Soc.*, **2**. 293.)
(*ZincEthylium. Ethylide of Zinc.*)
$C_4\,H_5\,Zn$

ZINCIDE OF IRON. Soluble in cold acetic acid. (Berthier.)

ZINCMETHYL. Decomposed at once by water.
(*Methylide of Zinc.*)
$C_2\,H_3\,Zn$

ZINC OXIMID.
$N_2\left\{\begin{matrix}C_4\,H_4''\\H_2\\Zn_2\end{matrix}\right.$

ZINCPHENYLIMID. *Vid.* ZincAnilin.

ZIRCONIA. *Vid.* Oxide of Zirconium.

ZIRCONIUM. Insoluble in water. Unacted upon by concentrated chlorhydric or sulphuric acid at the ordinary temperature, and only slightly acted upon by them after long-continued boiling. Nor is it any more strongly attacked by nitric acid, or aqua-regia. Easily soluble in fluorhydric acid, and with violence in a mixture of fluorhydric and nitric acids. Insoluble in aqueous solutions of the caustic alkalies, either cold or boiling. (Berzelius, *Lehrb.*)
Zr

Zuckersæure. *Vid.* Saccharic Acid.

ERRATA.

Page 2, column 2, line 29 from bottom, for 1.0539 read 1.0534.*

Page 3, col. 2, line 32 from bottom, for "one" read three.

Page 5, col. 1, line 15, for "one" read three.

Page 6, col. 1, line 31 from bottom, for "one" read three.

Page 6, col. 2, line 6 from bottom, for "one" read three.

Page 7, col. 1, line 12 (and in several other places in the first sheets of the work), for "Thompson" read Thomson.

Page 7, col. 1, line 27 from bottom, for 1.0366 read 1.0356,* and for 1.1330 read 1.1390.*

Page 8, col. 1, line 21 from bottom, for 1.1180 read 1.1190.*

Page 9, col. 1, strike out lines 5 – 8 from bottom.

Page 10, col. 2, line 30 from bottom, for 1.1755 read 1.1745.*

Page 49, col. 1, transpose line 10 to its proper place on p. 48, col. 2; also transpose lines 11 and 12 to the top of the column.

Page 91, col. 1, transpose lines 21 – 25 to their proper place, below line 6; also transpose lines 32 – 35 to below line 20.

Page 101, col. 1. At line 30 from bottom insert, 1 vol. of concentrated sulphuric acid, at 11° and a pressure of 0^{m}. 757, absorbs exactly one volume of $C\,O_2$. (Persoz, *C. R.*, 1841, **12.** 513.)

Page 145, col. 1, lines 32 – 35. The statement concerning basic chloride of aluminum is incorrect. Soluble compounds as basic as $Al_2\,Cl_3$, $4\,Al_2\,O_3$ have been obtained by Ordway.

Page 156, col. 1, line 24 from bottom, for "one" read three.

Page 161, col. 1, line 42, for "one" read three.

Page 195, col. 1. Transpose lines 32 and 33 to their proper place, above line 16 from bottom.

Page 216, col. 1, line 23 from bottom, for "carbonate" read chromate.

Page 216, col. 2, line 7, for "zinc" read silver.

Page 237, col. 1, line 28, for "$C_4\,H\,N_2$" read $C_4\,H\,N_3$.

Page 337, col. 2, line 22, for "0.401" read 1.401.

Page 375, col. 1, lines 12 and 16 from bottom, for "6" read 2.

Page 382, col. 1, line 17, for "1.27" read 1.37.

Page 382, col. 1, line 37, for "arsen*ic*" read arsenious.

Page 414, col. 1, line 25, insert, Easily soluble in wood-spirit.

Page 582, col. 1. Instead of lines 1 to 4 from bottom, read

570	. . . . .	1.778
580		1.780
590		1.781
600	. . . . .	1.782

(Anthon, *J. pr. Ch.*, 1836, **7.** 70.)

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* The items marked with an asterisk have been pointed out to me as apparent errors; they all occur in the original authorities. F. H. S.

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